RAILROAD GAZETTE

FRIDAY, JULY 5, 1895.

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Contributions.

Mr. Morison's Address.

NEW YORK, July 1, 1895.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Very few scientific societies this year will have the pleasure of listening to so able an address as was delivered to the American Society of Civil Engineers by its president Mr. Morison, on June 20th. It is an address which sets men thinking. Thinking leads to criticism, and here is some of it.

Mr. Morison defines a civil engineer as one whose business it is to design the tools by which the sources of power in nature are directed for the use of man.

This definition is not broad enough, and should be made to include the sources of power in nature and in man himself. It would then cover the design of all mechanical tools, such as sewing machines, bicycles, etc., which are certainly pieces of engineering of the highest kind. A very useful member of the civil engineering profession is he who gives us good pavements. He is nothing but a reducer of friction, and that is all that an engineer of railroads is. Can friction be called a power of nature?

A broader definition of engineering is "scientific design and construction."

A man who digs a ditch is a constructor; one who designs and constructs a sewer according to mathematical laws is an engineer. A man cannot do this unless he has been taught to think.

One of the best things in Mr. Morison's address, which deserves to be printed in large letters on the door of every school, college and university in the land, is: "The real difference between a liberal and a special education is that one teaches the student to use his mind, and the other gives him information." The civil engineer must use his mind to observe, collect, weigh and reject facts: to draw conclusions from those that remain, and finally to confirm or disprove those conclusions by experiment. This is scientific method, and civil engineering is "scientific design and construction."

T. C. CLARKE.

The Mechanical Engineers' Convention.

Although the attendance at the Detroit meeting of the American Society of Mechanical Engineers was not as large as usual, there was a sufficient number present to insure good discussion of the papers, and the result was satisfactory and profitable. The meeting was favored by perfect weather, and, as the engineering attractions in Detroit are few, the sessions were unusually well attended throughout.

After arrival the entire party was taken by boat to the City Park, which occupies the whole of Belle Isle. three miles long and one mile wide. Carriages were in waiting to drive the visitors over the island, affording opportunity of seeing the well-designed park with its forests, lagoons, deer parks and gardens.

The first meeting was called to order in the hall of the Y. M. C. A. by President E. F. C. Davis. Mr. Robert Allison presented his paper on "The Old and the New," describing the character of machine shops in his boyhood days. The paper was supplemented by Samuel Webber, Olin Scott, Ezra Fawcett, J. F. Holloway and Washington Jones, who referred to shops and devices used in the early part of this century, presenting sketches of ancient boring devices for driving gears of such large dimensions that the tools were mounted on the work instead of the reverse as is done at the present time. J. L. Rockwood and W. S. Rogers, in contrast, presented some data upon new work; the former describing the new Hydraulic Testing Station of the Worcester Polytechnic.

The papers by A. M. Goodale on "A New Form of Sterilizers," and by W. H. Francis on "A Portable Disinfecting Plant," were read, but not discussed.

After these papers, topical questions were taken up. The first one related to the Utility and Applicability of Milling Machines vs. the Planer. This question caused an animated discussion, which was opened by Mr. Henry Buisse, of Newark, N. J., whose experience showed that the milling machine was not applicable for jobbing work, as the cost of special tools and time required for setting the work on the machine were so great as to make the milling machine prohibitory. When many duplicate pieces were required, he thought this would not be so. W. S. Rogers insisted that when a shop was properly equipped there was no better tool for jobbing than the milling machine, while he had no use for turret lathes, shapers and similar tools. Chas H. Norton, of Detroit, thought that each machine showed best results under special conditions, but that no tool produced as cheaply as the milling machine.

After the evening session a reception and lunch were given by the Y. M. C. A.

On Wednesday morning the Secretary reported the election of more than 75 new members.

The Council announced the appointment of a committee of engineers and architects on Fire Proof Qualities of Materials of Construction, and stated that a member of the society, M. H. deB. Parsons, had been appointed to represent the American Society of Mechanical Engineers on that committee. The committee called for assistance from members of the society and stated that any materials submitted for test would be gladly accepted and tested and reports on results furnished.

The Committee on Standard Tests and Methods of Testing Materials of Construction presented three papers on Cast Iron: the first containing the historical part relating to the method of obtaining material and test bars, operation of cupola, and general data in reference to procedure during preparatory work and testing.

The second paper was an abstract of results of transverse tests of various size of bars; the third was a report on shrinkage and cooling curves as obtained by an autographic recording device, which showed the behavior of bars of metal while cooling from high temperature. These two papers were written by W. J. Keep, of Detroit.

The paper on transverse strength of cast iron developed the remarkable fact, that the sizes and shapes of cast-iron test bars in common use were precisely those which gave us least information about cast iron, while either larger or smaller bars could be used to show the characteristic variation in strength due to chemical composition. The tests showed that while cast iron of high Si. gives highest results in small bars, it weakens iron in large shapes, and also the reverse, that low Si. iron is weak in small sizes and strong in large ones. The paper points out that the character of grain is of the greatest importance in determining strength and that "grain closers" are of the greatest importance in producing strong irons.

The third paper, on "Cooling Curves," was the report of an autographic record of the behavior of cast bars in a flask while cooling, and showed plainly that the behaviour of bars as to shrinkage, contraction and expansion is directly influenced by the chemical composition. It is proved that many irons, especially those containing high Si., expand before cooling to a slight degree, its amount depending directly upon the per cent. of Si., but that the time of the expansion, and also of shrinkage, depend also upon the per cent. of Mn., S. and P. The very similar behavior of cast-steel bars was also shown by similar curves. A special investigation showed that carbon crystallizes out of the iron at about 12 to 15 minutes after the 1-in. iron bars are poured, and that while the bars are already solid but still in an amorphous condition; the total carbon is originally in complete solution, and that it gradually separates during a long period after losing fluidity. The result of using bars was also shown, and it was proved that crystallization and strength of iron is entirely dependent upon rate of cooling.

These papers were discussed at length by Prof. J. B. Johnson, J. C. Platt, D. L. Barnes, W. F. Rogers, Wm. Kent, Ad. Sorge, Prof. R. C. Carpenter and G. C. Henning. The discussion brought out the fact that the results were entirely corroborative of common foundry practice and that our knowledge of the subject was largely increased and confirmed by the results of the tests. Prof. Johnson and Mr. Rogers were of the opinion that transverse breaking strength could not be deduced from elastic theory, as formulæ were only true within elastic limits and not beyond. Hence they proposed to rely for strength on tension tests rather than transverse, but failed to explain satisfactorily how this was to be done.

The paper on "Cooling Curves" was a revelation, and although very interesting, they had been discovered so recently (May, 1895) that it was not yet possible to predict what value they might have. Messrs. Sorge and Carpenter gave testimony to the practical value of the tests and especially to the admirable character and value of the work of the committee.

The Committee on Standard Gages reported in favor of the use of the decimal nomenclature in preference to all other standards, gages, numbers or marks. Report accepted.

The Secretary read an abstract of F. W. Dean's paper on "The Efficiency of Steam Boilers: a Criticism of the Society's Standard Code of Reporting Boiler Trials.' This paper brought out a lively discussion, which finally resulted in adopting a resolution to the effect that "the Council be requested and directed to appoint a committee of nine members, to reconsider the standard method (of 1886) of steam boiler trials, reported by a committee of the Society at that time, and to report the results of its deliberations to the Society."

The paper was discussed by Professors Jacobus, Denton, Carpenter and Potter, and Messrs. Bryan, Henning, Robt. W. Hunt, Rockwood, D. L. Barnes, J. F. Holloway and Mier. The general concensus of opinion was that the Report of 1886 was antiquated, and that the Society should have the subject reinvestigated; that the standard of evaporation should remain at 35 lbs. water per H. P. per hour; that chemical analysis was unsatisfactory to determine the calorific value of fuel; that coal or fuel calorimeters should be used instead, and that a longer continued test with a "flying start and finish" should be used to obtain trustworthy results. Profs. Denton and Jacobus presented sketches of a boiler with grate arranged on platform scales, in order to determine the actual weights of fuel as formed and remaining on the grate, instead of guessing at the fuel on the grate and ash and clinkers under it as has been customary heretofore.

Upon completion of this discussion the members adjourned to the roof garden of the Chamber of Commerce, the tallest building in Detroit, where a lunch was served.

After lunch the discussion of papers was resumed by taking up that of W. A. Gabriel on "A T-Square and its Mountings," followed by that of De Volson Wood, on "The Strength of Iron as Affected by Tensile Stress while Hot." Professor Carpenter gave some results on tensile strength while hot and cold, showing that there is a decrease in strength while hot as well as while cold at and below 32 degs. Fahr., but that this is not serious and that metal is strongest at ordinary summer temperatures.

Prof. R. C. Carpenter's paper on "The Effect of Length of Specimen on the percentage of Elongation" was read and discussed by Mr. Henning, who pointed out that the results were substantially what had been reported by the Committee on Standard Tests and Methods of Testing Materials, and that J. H. Wicksteed, of Leeds, was probably the first to point out the fact again verified in the paper that the percentage of elongation of steels was identical for all lengths of specimen, when measured at the instant of maximum load instead of after rupture as has become so common a practice.

DRIVING AND PULLING CUT AND WIRE NAILS.

Prof. R. C. Carpenter, of Cornell, presented a paper showing the results of experiments to ascertain the force required and work done in driving and pulling cut and wire nails. The general summary of the experiments is that: First, very much more force is required to drive a cut nail a given distance than a wire nail. Second, more force is required to start a cut nail generally than to drive it, and that it invariably starts much harder than a wire nail. Third, the work in *inch-pounds* per nail required in driving cut nails is much more than that in driving wire nails. Fourth, the work in *inch-pounds* in pulling cut nails is about equal, sometimes less and sometimes greater, per nail, than that for pulling wire nails. Fifth, the maximum force per pound in driving or starting wire nails is more nearly equal to that of the cut nails than when estimated on the basis of that of a single nail, but it is still less. Sixth, the work, in *foot-pounds*, per pound of wire nails, required for driving is less than that required for the cut nail, and that for pulling is considerably more. Seventh, the relative efficiency which is here considered as the ratio of the work of pulling to that of driving is much higher for the wire nail than for the cut nail.

In making experiments it was noticed that the cut nail bruised and broke the fibers of the wood, principally at the end of the nail, whereas the wire nail simply crowded them apart, and probably did not move them much beyond the point from which they would return by elastic force, and hence the nail would be grasped much stronger per unit of area of surface by the wood. Presenting less surface, there would be, however, less resistance to starting.

To see what the effect of change of form would be, a number of tenpenny cut nails were sharpened on the point by grinding to an angle of about 30 deg., so that the fibres in advance of the nail would be thrust aside and not bruised and broken. This served to increase the holding power over the cut nail of ordinary shape about 50 per cent, in starting force, and about 30 per cent. in work of resistance to pulling.

The paper is accompanied by numerous tables and diagrams, showing in detail the results.

This was discussed by Prof. R. H. Thurston, J. M. Sweet and G. C. Henning. The first pointed out the value of these tests, as proven by experience and showing the advantage of use of different kinds of nails. Mr. Henning pointed out that the experiments were somewhat misleading in regard to value of wire nails as, in all cases the wire nails were only 66⅔ per cent. of the weight of cut nails, while to make true comparisons nails of same weight or same volume should have been used to show the true relative holding values of nails. Mr. Sweet pointed out that these nails were all driven normal to fiber into board, but not edge or endwise, as is most commonly done, and that when thus driven the results would be very different. He pointed out that boxes in which cut nails were used would go all to pieces in transit, while the use of wire nails would have insured their safe transportation.

Prof. W. F. M. Goss's paper on "New Forms of Fric-

tion Brakes" was discussed by Professor Jacobus and Messrs. Willis and Sweet.

The former explained a hydraulic friction, multiple disc brake, as used on torpedo engines, which moved at very high speeds and developed power during a fraction of a minute. This brake consisted of a series of discs, one half secured to the shell and the other half to the shaft, between which water forced outward by the centrifugal force produced sufficient friction to absorb all the work of the torpedo engine smoothly and very steadily. He also described his rope brake, in which 150 H. P. were absorbed by rope friction on a revolving grooved pulley, which two internal flanges in which water was fed and evaporated by work converted into heat. This was very satisfactory. Professor Sweet gave similar experience, in which he kept water running on the ropes, as well as within the pulley so as to prevent charring of ropes.

Mr. E. T. Willis next read his paper on "A Horse Power Planimeter," which described a new design of planimeter by means of which the horse power developed, mean effective pressures, or any other integration or product can be read off the measuring wheel instantly, without any other operation. The wheel is adjustable to any valve desired, and in case of indicator cards the results of mean effective pressures and total horse power can be read off as fast as cards can be taken. Professor Jacobus, who has used the instrument for some time, testified to its value and accuracy and praised it very highly.

The next paper presented was by Prof. R. C. Carpenter on "A Coal Calorimeter." Professor Jacobs praised this instrument and pointed out the necessity of using such device for the determination of calorific value of fuels, as the chemical analysis did not correctly indicate it. The presence of widely varying volatile matter of water and of nitrogen made it almost impossible to correctly calculate calories in fuel while the apparatus did this, and only required calibration.

Mr. Kent thought chemical analysis sufficient, but admitted the value of such instrument.

Mr. Henning pointed out several points of faulty construction and showed how they could be avoided and also how to prevent erroneous results. He showed how the instrument could be better adjusted, how the air could be vented and how air could be precluded from entering. Professor Carpenter stated that he had discovered after six months of study what Mr. Henning had pointed out in one instance and that he should certainly adopt the other suggestions made, as they would, no doubt, much improve the apparatus and overcome difficulties heretofore met with.

Next Prof. D. S. Jacobus presented his paper on Tests to Show the Distribution of Moisture in Steam when Flowing in a Horizontal Pipe. He showed that no reliance could be placed on calorimeters placed on a horizontal pipe, as the water separated from the steam and flowed either on the bottom of the pipe or whirled around the sides of the tubes, depending upon the rate of flow of steam. Professor Carpenter then explained his experiments with calorimeters on vertical pipes, and showed that any percentage of moisture might be obtained, according to location of orifice, and hence that no correct estimate of entrained water could be secured without special devices. He had tried straining the water and steam through a very fine meshed brass wire screen, and thinks he may have obtained a correct sample of steam in the calorimeter placed just beyond this screen; his experiments required confirmation, however. Mr. D. L. Barnes also spoke of the unreliability of calorimeter results, as it was not certain to trap correct samples of steam.

THE PIECE RATE SYSTEM.

Mr. F. W. Taylor, of the Midvale Steel Co., of Philadelphia, submitted a paper on the piece rate system as describing a step toward a partial solution of the labor problem. The paper as printed fills 27 octavo pages, therefore we cannot attempt to do any justice to it in a synopsis. We recommend it highly, however, as a clear, detailed and philosophical account of a system which has been pursued for 10 years in the works of the Midvale Steel Co., with the most satisfactory results. The three principal elements of that system are: First, the rate fixing department; second, the differential rate system for piece work; third, the method of managing men who work by the day.

The elementary rate fixing as practiced there is based on a careful study of the time required to do each of the elementary operations into which the work may be divided. These are classified, recorded and indexed and when a price is wanted the job is divided into its elementary operations and the total time summed up.

The differential system consists of offering two rates for the same job. A high price per piece is paid if the work is finished in the shortest possible time and in perfect condition; a low price if it takes longer or if it is imperfect when turned out. The high rate permits workmen to earn more per day than is usual in similar establishments. This differs from the ordinary plan which reduces the wages of workmen when they increase their productivity.

The day work plan adopted pays the men according to individual skill, and not according to position. Each man's wages are fixed according to the skill and energy with which he does his work. This involves keeping records of each man's punctuality, attendance, integrity, rapidity, skill and accuracy, and a readjustment of his wages from time to time.

The advantages of the system practiced at Midvale are: Reduced cost of product and higher wages to the men; the removal of the motives for "soldiering," and the consequent disappearance of the greatest cause for hard feelings between the management and the men; greater uniformity and justice because of more exact basis for prices, and consequently more and better work; a common interest between the management and the men; rapidity in attaining the maximum product of men and machines, and the automatic maintenance of this rate of product; the automatic selection of the best men, and the development of high class men and sifting out of the incurably lazy or dull ones; friendly feeling between men and employers, rendering unions and strikes unnecessary.

There has never been a strike under this system, although it has been in operation for 10 years in a business peculiarly subject to strikes and labor troubles.

In the preparation of Mr. Taylor's paper he has divided the body of it into 93 paragraphs numbered, and has prepared an index referring to these paragraphs, by number in order that those who will not read the whole paper can pick out easily the parts which they wish to read. In treating the subject he reviews various plans that have been tried or suggested and altogether has given us a singularly valuable study. The one great principle underlying the whole scheme is that "men will not do an extraordinary day's work for an ordinary day's pay." Any attempt to arrive at such a result is doomed to failure.

Among the results of the system as carried on at Midvale has been a steady improvement in the design of the machines used, which has come from the careful scrutiny of the elementary operations.

We are sorry that Mr. Taylor does not give more instances of the results of their system. He does give one, however, which is characteristic and interesting. A certain standard steel forging had been turned out for several years at the rate of from four to five a day, 50 cents per piece being paid. An analysis of the elementary operations showed that it was possible to turn out ten pieces a day, the machinists working at the maximum pace from morning to night and the lathes running fast under a heavy feed. The work involved removing with a single 16-in. lathe, having two saddles, an average of more than 800 lbs. of steel chips in ten hours. In place of the 50-cent rate the men were given 35 cents when they turned out these forgings at the speed of ten a day and 25 cents apiece when they produced less. At first it took some trouble to induce the men to turn at the high speed, but when they found that they could permanently earn $3.50 a day the matter was settled, and for ten years the work has been done at this rate. During this period the competitors of the company never succeeded in averaging over half this product, but they did not allow their men to earn more than from $2 to $2.50 a day. Under the Midvale system this particular product is turned out at the cost of 69 cents per piece, the men earning $3.50 a day. At the old rate producing half as many pieces, the cost per piece was $1.17 and the men earned $2.50 a day.

In the discussion W. S. Rogers said that any system of piece rate must depend upon the men and the shop system, but that he could see no good in the system proposed. D. L. Barnes asked how apprentices were treated, and was told, "just the same as men on a lower scale, until their work equalled that of men on a higher scale." Mr. Henning spoke of the good results obtained by the system, and of the humanitarian principles underlying the same, to which Mr. Halloway agreed. Mr. Stanwood asked what was done in 1893 in the shops where this system had been tried for many years, and was told that the management showed total breach of faith toward their men in making an unwarranted "horizontal cut," from which the shops had not yet recovered, as the men had lost faith in their employers, which it would take a long while to re-establish. Messrs. Norton, J. C. Platt, Gobeille, Bement and W. R. Warner all discussed the paper in a complimentary manner showing the applicability of the system to various conditions, even in case of women and apprentices

William H. Bryan read a paper on "The Drawn Draught Furnace for Steam Boilers," and Alex. Dow described a similar plant at the Detroit City Light and Power Plant, which was visited by the society during the afternoon. A. F. Nagle pointed out the low efficiency reported, which Mr. Kent explained on the ground that the heating surface was deficient, this being a universal error in Western practice. Professor Carpenter laid the low efficiency to bad firing, as shown by chimney gases, and Colonel Mier and D. L. Barnes thought Mr. Kent wrong, and that low efficiency was due to kind of coal more than anything else, and explained that preliminary tests are made to determine this fact.

E. T. Armstrong's paper on "A New Shaft Governor" was discussed by Ezra Fawcett and Robert Allison, who said that he doubts that a governor can run faster when load is increased. Professor Sweet thought this might be so, but preferred one which just about held its own, which Mr. Holloway said was done by the Sweet governor in the straight line engine.

E. C. Knapp's paper on "A Method of Proportioning the Cylinders of Compound Engines" was discussed by Geo. I. Rockwood, who pointed out that the author based his computation on equality of clearance in high and low pressure cylinders, which was not usual or obtainable in practice, and therefore the results were misleading; this assumption was made, as otherwise formulæ and calculation would become too complex.

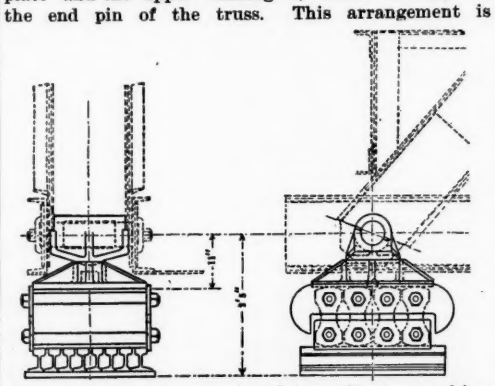
Thursday afternoon was occupied by an excursion to the Lake St. Clair Flats and the Venice of America, where dinner was served.

EXPANSION BEARINGS FOR BRIDGE SUPERSTRUCTURES.

Mr. George S. Morison, member of the society, presented the following paper:

In the paper on Expansion Bearings for Bridge Superstructures, presented at the New York meeting in December, 1893, I described the development of expansion bearings for bridges, and especially the development in my own practice, and closed with a description of the expansion bearing which I had adopted as a standard practice in all ordinary cases, simply varying the dimensions and number of rollers. [See *Railroad Gazette*, Dec. 8, 1893.]

Since then I have found it expedient to make certain possible modifications of this bearing. The bearing then described is very high; it requires, below the center line of the chord, one-half the depth of a stiff chord, besides the depth of the top plate, of the rocker plate, of the bearing plate, of the rollers and of the rail plate. This height can be materially reduced by substituting for the rocker plate and the top plate a single steel casting, which may be called a pin casting. The bottom bearing of the pin casting is finished to a cylindrical surface corresponding to the under side of the rocker plate and the upper bearing is taken directly on the end pin of the truss. This arrangement is



shown on the accompanying sketch. The two rocking surfaces at right angles to each other are retained; one of these is the cylindrical surface on the under side of the pin casting, and the other is on the pin itself. The arrangement, therefore, adapts itself to all irregularities of bearing, as well as the standard with the rocker plate does. It is very much more compact, as, in the small four-roller bearing shown in the sketch, it saves 10 inches in height, and the saving would be greater under heavier spans. Where ample height can be had it has no advantages, and even has the disadvantage of making the bearing surfaces comparatively inaccessible.

This modified bearing can be used where the end panel of the bottom chord is of eyebars, the pin casting taking the place of the usual bolster. If the standard bearing, as formerly described, is used under a bolster, the pin on which the bolster turns and the rocker plate make two rocking motions in the same plane, a condition which is necessarily unstable. All the older bridges have eyebars in the end panels of the bottom chords. This cannot now be considered good practice for through bridges, though it is, perhaps, all right for deck bridges. The arrangement now described adapts this system of bearing to structures of this class.

Prof. R. C. Carpenter read an abstract of his paper on "Tests of the Experimental Engine of Sibley College," which was criticised by Wm. Kent because there were no conclusions given and the engine does not agree with present practice, and clearance is too large. Geo. J. Rockwood wished to know results of engine without the intermediate cylinder and suggested that the condenser is the cause of low efficiency. Prof. Storm Bull said that large clearance was not the cause of it, as suggested by Wm. Kent, and he also laid it to the condenser.

Mr. Jesse Smith mentioned that these tests giving low efficiencies were made on engines running under varying loads, while all pumping engines tested and giving such high efficiencies which were used as standard were obtained under constant loads.

The next paper by D. C. Jackson on "Tests of a Combined Electric Light and Railroad Station," was dissussed by Prof. F. M. W. Goss, who pointed out that the coal consumption of this engine was precisely the same as that of locomotives. Professor Carpenter stated that in his many tests of electric plants, being over 50 in number, using all kinds of coal, he found a consumption of slightly more than 6 lbs. per H. P. He found engines using 100 lbs. coal down to 20 lbs., all very uneconomical, and has never found one single plant which was economical.

The last paper presented was that by Geo. M. Brill, on "Pipe Covering Tests," which was discussed by F. W. Taylor, who gave his own experience in the Midvale Steel Works, referring especially to durability, which was pointed out to be the real test of the value of any pipe covering otherwise good. This experience showed that ¾ fossil meal applied in one wash and three layers, then covered by 1 in. hair felt, gave best results. He emphasized the fact that the method of application and the care used were all-important, and that 7½ years showed no appreciable change or wear when properly done. The 1-in. layer of hair felt was wrapped very tightly by strong, elastic twine, this covered

with resin-sized paper which was again covered by canvas and finally carefully painted with a red oxide paint. Fossil meal did not shake loose from the pipe, nor was there any sign of displacement of hair felt, although the covering in some places seems to have sagged about ¼ in. Samples of hairfelt cut from the covering after 7½ years, and where the pipe had been walked upon, showed a loss of about ¼ in. Professor Carpenter had found rather more condensation than reported in the paper, but he explained that by saying that the covering he used was not as thick as that experimented upon by the author.

Accounting Officers' Association.

The annual convention of the American Association of Railway Accounting Officers, held in Detroit, May 29, was briefly reported in the *Railroad Gazette* of June 7. We have endeavored to get a fuller report of the proceedings, but we find that the discussions were not made a matter of record, and that the principal features of interest in connection with the meeting, aside from technical details, which are to be found in the official report of the Secretary, are covered by the addresses of the President and of Messrs. Douglas and Joslin. These addresses we give in abstract.

PRESIDENT'S ADDRESS.*

The opening of this, the seventh annual meeting of our association, brings to our minds the fact that we are passing out of our infancy, and, with our increasing years, the position we hold in the railroad world grows more important. Recommendations of past standing committees continue to bear good fruit. Interline accounting methods and blanks, recommended by the Association, are being more generally adopted. Within the past few months the roads comprising the West Shore l ne have adopted our Niagara Falls plan of interline freight account settlements, through the audit office. The association's standard form of way-bill is in more general use than it was a year ago. Your executive committee's report sets forth the result of the conferences with the interstate and state railroad commissioners. The work of explaining to the Commissioners that these statistics (resolutions of Commissioners May, 1894, requiring roads to show freight earnings on each of 33 commodies, and to apportion interstate earnings to the different states on the basis of local rates in the states through which each consignment passes) would cost more than any benefit from them would warrant was left to your executive committee, which estimated the cost to the roads of the country to be upwards of two millons of dollars. We may well congratulate the railroads on the result. No reputation for junketing can be laid to our door. We are educating each other. The auditing officers have too long had the reputon of being unprogressive, but they are every day becoming less so. Improved auditing methods decrease expense, without destroying the value of the audit. Enthusiasm must be our key note. Without it our work will always be drudgery and our progress slow. In running an office there should be a minimum of pedagogism with a maximum of *esprit de corps.*

RELATION OF STATION AGENTS TO ACCOUNTING DEPARTMENT.†

The relation of station agents to the accounting department is that of trusted representatives, having charge of the collection and remittance of the revenues of their stations, the accounting department acting as the judge as to their correctness and integrity. The accounting department prescribes the methods by which he shall regularly record, report and account for all the business transacted. Some railroads have adopted the plan of having the accounting department appoint an accountant to supervise the station accounts and assist the agent in his office duties. This is an important innovation; and, from my own experience, I believe it to be a very advantageous and necessary one.

INTER-LINE TICKET CORRECTION CLAIMS AND DIVISIONS.‡

Should, or should not coupon ticket correction claims, or, more properly speaking, claims for correct proportions, be handled through the accounting department?

The subject of divisions as applying to through or inter-line rates is becoming more complex from year to year, with increasing diversity of opinion as to the proper basis, of dealing with claims. Cannot these claims be handled by the accounting department as well as by the passenger department? The apportionment of interline ticket sales is quite generally considered a part of accounting department work. The work of making divisions, by which means are supplied the items to be distributed by the apportionment clerk, is largely performed in the passenger department. A diversity of practice likewise prevails with regard to the checking of proportions on inter-line ticket report received from other companies. The lack of uniform practice results in a more or less mixed condition of affairs with respect to the correspondence regarding claims. My opinion is that the accounting department should handle correction claims. For the past twenty years the accounting department of our company has had complete charge of the coupon division work, issuing and prosecuting correction claims, as well as taking up the consideration of claims received from other lines, working in perfect harmony with our passenger department. I believe that the work has been conducted at less expense and with fully as close watch upon the interests of the company as could have been obtained under a more divided responsibility. The General Passenger Agent naturally devotes his time, energies and talents to the work of getting the business; the distribution of the revenue, after it has been secured, must be performed upon well defined principles, and it is to be presumed that the general passenger agent would willingly be relieved of the responsibility.

Railroad Legislation in Arkansas.

The Legislature of Arkansas has passed this year about a dozen laws affecting railroads. As no one of them seems to be of predominant importance we note them in the order of their passage.

Act 8 revises and extends the charter of the Mississippi Valley Railroad Co., so as to remove all doubts by reason of non-compliance with the act of 1889.

Act 15 prescribes the manner in which corporations may reduce their capital stock, either by releasing unpaid subscriptions or by refunding to shareholders a portion of the amounts paid in by them.

Act 30 regulates the sale of unclaimed freight and baggage. Such goods remaining on hand six months may be sold at auction, on 20 days' notice and proper advertisement. A provision in the law forbids railroads to charge storage on baggage for the first 48 hours, or to charge more than five cents a day thereafter. This provision seems to allow a charge of five cents a day on each 150 lbs.

Act 51 requires railroads to give each shipper of live stock, by the carload, a pass to destination and return, under penalty of from $100 to $500.

Act 77 exempts sheriffs from section 6,275 (and the four following sections) of the statutes of Arkansas, and says that it shall not be unlawful for railroad companies to furnish free passes to sheriffs. This bill became a law without the approval of the Governor.

Act 85 amends the law concerning guaranty and surety companies. When such a company refuses to give a bond for a person it must furnish a written statement of the reasons therefore, and the names and addresses of informers if there be such. Failure to comply within 30 days after request makes the guaranty company liable under the bond which it has deposited with the State Treasurer. This act applies only in cases where the employer of the individual who desires to be made the subject of the bond, will accept the bond of only one guaranty company; the effect being, apparently, that if a railroad company gives its employees reasonable latitude in finding a bondsman the law does not apply.

Act 112 makes it unlawful to charge more freight on a double-decked car of sheep than upon a car of live stock other than sheep.

Act 153 requires all railroad and vessel agents in the counties of Arkansas, Lonoke, Monroe, Prairie and Crittenden to keep a register of live stock exported from the county, showing the number. mark, brands and a general description of the animals. The items of these registers must be filed with the County Clerk once a month, and the Clerk must be paid 25 cents for each report.

Act 153 extends for 18 months, the time in which certain railroads may comply with the provision of their charters requiring them to complete five miles of road.

Railroad Legislation in Illinois.

The General Assembly of Illinois, which adjourned June 14, passed five bills affecting railroad interests. The first of these laws, Senate Bill No. 285, increases fees charged by the Secretary of State for incorporating all companies (including railroads) and for filing certificates of increase of capital stock. A fee of $30 is required to incorporate a company having a capital stock of $2,500, or less; and all companies having a capital stock of more than $2,500, and less than $5,000, pay $50; while all companies with a capital stock of more than $5,000, pay in addition to the required $50, $1 for each $1,000 in excess thereof. A fee of $1 will be charged for each $1,000 of increase in capital stock.

Senate Bill 346 directs the Attorney-General to institute proceedings in the Circuit Court for the dissolution of corporations, organized either under general or special law, that have ceased to do business under their charter.

House Bill 287 amends the law requiring railroads to erect depots and freight houses at small stations. They are now required to maintain such buildings in all towns or villages having a population of 200 or more.

Senate Bill 309 prohibits the obstruction of any public highway by leaving any car, engine or train longer than 10 minutes across the same and provides a penalty of $200 against any person who shall throw any stone or other missile at any train, engine or car.

House Bill 485 amends the act of March 30, 1875, relating to railroad leases. It provides that all railroad companies incorporated under the laws of Illinois, or any adjoining state which may now or hereafter be in possession of or operating connecting railroads in Illinois or adjoining states under lease in perpetuity or for a period of more than 20 years, shall have power to buy or sell the remaining interests of property and franchises of the lessors of such railroad on such terms and conditions as may be agreed upon by the parties or their assigns to such lease, and the purchaser shall operate and hold such road and franchises subject to all the rights, privileges, duties and obligations prescribed by the general railroad laws of Illinois, now or hereafter to be enacted. The act does not permit the purchase of such interests of competing or parallel lines.

Three days after the adjournment of the regular session of the Illinois Legislature, Governor Altgeld recalled its members in special session, which convened June 25, to consider, besides the subject of the revenue deficiency, which afforded the principal constitutional justification for the extraordinary step, the following questions in which, if action is taken, railroad corporations doing business in that state will be interested:

A revision of the revenue law because of the escape of a large proportion of corporate and other wealth from all taxation; the abolition of the state board of equalization because that body, it is alleged, shields the great corporations from fair assessment and enables them to escape taxation; the creation of boards of conciliation, inquiry and arbitration in cases of disputes between employer and employees; the enactment of legislation fixing charges for sleeping cars.

Railroad Legislation in Minnesota.

The Minnesota Legislature of this year passed several laws affecting railroads. One of the most important is No. 40, amending the law of 1887 creating the Railroad Commission. As amended, Section 3 of this law requires railroads to provide ample facilities, equal and reasonable, for the interchange of cars at junctions, the cost to be apportioned between the companies by the Railroad Commissioners when the parties cannot agree. Railroads must establish reasonable joint through freight rates and run carload lots through without unloading; they shall at all times give the same facilities to local as to interstate traffic. If railroads fail to establish through rates the Railroad Commissioners must make tariffs. But nothing in this law shall require a railroad to send its cars over a competing line or to use its tracks or ter minal facilities for such lines. It shall be unlawful for a carrier to contract to limit its common-law liability on shipments of freight.

Section 9 of the law of 1887 is amended so as to more strictly prohibit the Railroad Commissioners from hav ing an interest in railroad companies.

Law No. 119 requires railroads to mark on the insides of freight cars the height at which grain may be safely loaded, and prohibits a charge for any excess above the carload rate if the load of grain does not fill the car to a point above the line. This bill contains several snappish provisions making it a misdemeanor to evade it.

No 173 amends the law of 1885 relating to the disposal of unclaimed freight and baggage. Whenever a written notice is served upon the owner, property may be sold within 90 days.

No. 341 declares express companies to be common carriers and makes them subject to the supervision of the Railroad Commissioners.

No. 96 provides that lands which railroad companies have acquired by grant from the state or the United States, and are used for the business of the road or for gravel pits, shall be taxed the same as other lands are taxed. This law takes effect from its passage, which was March 19, but there is a section submitting it to the approval of the people of the state at the next general election.

No. 295 exempts railroad scales from the jurisdiction of the city sealer of weights and measures, where they are under the supervision of the state grain weighing department.

No. 316 requires railroads to keep empty cars closed, in order to prevent the spread of seeds of noxious weeds. The willful violation of this act subjects the company to a fine of from $10 to $25 for each offense.

No. 120 prescribes the procedure in cases of indictment against a corporation for a crime.

No. 344 requires corporations of other states to appoint an agent in Minnesota on whom legal papers may be served.

New Wabash Shops of the C., C., C. & St. L.

The Cleveland, Cincinnati, Chicago & St. Louis Railway is building new shops at Wabash, Ind., which will probably be completed about October 15, 1895. They comprise erecting, machine, boiler, blacksmith, tin and wood shops, and boiler and stationary engine rooms, also a brick chimney for the stationary boilers, a transfer table pit, a 15-stall engine house, a turn table pit, offices, oil and store rooms, freight car repair shop, sand house, coal docks, etc., etc.

Fig. 1 shows a plan of the tracks and yard, showing the position of the shops, engine house, freight car repair shop, etc. The specifications require the best material and workmanship obtainable, and provide that the work is to be completed with the least possible interference with the business or traffic of the road.

The foundations of the buildings will be of rubble masonry, the lower courses being laid with extra heavy and large stones.

The ground plan of the main building, containing the erecting, machine, boiler, blacksmith, tin and wood shops, boiler and engine rooms, etc., is shown in Fig. 2. These shops will be of U shape, with brick walls, stone foundations, stone caps and water table. The erecting shop is to be 60 ft. × 160 ft.; the machine shop, 60 ft. × 99 ft. 5½ in.; the boiler, blacksmith and wood shops, 60 ft. × 79 ft. 5½ in.; the tin shop, 23 ft. 11 in. × 38 ft. 11 in.; boiler and engine room, 35 ft. × 38 ft. 11 in. In addition to these there will be an office, 37 ft. 5 in. × 22 ft. 10 in., shown in Fig. 2.

The roof trusses are to be of medium steel, either open hearth or Bessemer. The design of the trusses for the blacksmith, boiler and erecting shop is shown in Fig. 4, the trusses having a 60-ft. span, and being placed 20 ft. c to c. The rafters are of yellow pine, 2 in. x 6 in., placed 24 in. c to c, and notched down 1 in. on purlins, to which they are fastened by U-bolts. The roofing is to be slate on two layers of tarred felt over Norway pine boards. The ridge pole and wall plates will be of yellow pine, the wall plates being bedded in concrete. Drainage will be provided for by means of 16 oz. copper gutters and leaders to underground cast-iron pipes.

The flooring of the various shops will be of oak, 3 in. thick by 10 in. wide, spiked to 6 in. × 8 in. oak mud sills. The floor of the blacksmith shop will be a 12 in. layer of cinders. That of the engine and boiler rooms will be cement 6 in. thick. The offices will be of brick and stone, with a gravel roof.

The roundhouse, as shown in Fig. 1, will be subdivided by one fire wall, extending 10 in. above the

* By Mr. C. I. Sturgis, General Auditor of the Chicago, Burlington & Quincy, and retiring president of the association.
† Abstract of a paper by Mr. A. Douglas, Auditor of the St. Louis & San Francisco.
‡ Abstract of paper by Mr. A. D. Joslin, Auditor of Passenger Receipts, of the Illinois Central.

roof line. The roof is to be of timber, with gravel and tar covering, the beams and purlins supporting it being of yellow heart pine. The former will be bedded on top of the columns and corbels, and bolted in place, while the latter will be hung to the beams with wrought iron stirrups, as shown in the engraving. The sheathing will be of 3 in. pine, tongued and grooved, and covered with 4-ply roofing paper, tar and gravel. A ventilator is framed over each stall, as shown in Fig. 3. At the bottom of the stall is shown the pit, details of which are given in Fig. 5. Its bottom is of 4-in. concrete, and a drainage basin is placed at its lower end, leading through a 6 in. pipe to the sewers.

pipe shown in Fig. 3. At *B*, Fig. 5, is shown a section of the pit through the catch basin at its lower end. The longitudinal section at *C* shows the connection of the catch basin to the main drainage. The track stringers and end timbers will be of white oak, anchored to the stone work. There will be a 4-in. cast iron water supply pipe to supply water to each pit. For heating there will be a coil of three ¼-in. steam pipes on all sides of the track pit and connected by underground piping to a 4-in. steam supply pipe, to be run around the building inside the rear wall. The contractors are re-quired to guarantee a minimum temperature of 68 deg. in zero weather.

sheathed and slated in the same way as the other slate roofs.

The space between the machine and erecting shops, in the main building, is not walled, but is crossed by a girder on posts as is shown in the floor plan, Fig. 2. The details of this girder and column construction are shown in Fig. 8, the posts being of 8-in. Carnegie Z bars, faced square at top and bottom, and fitted to base plate castings resting upon stone piers. The girder is in three 20-ft. spans and is composed of two 15 in. I-beams weighing 60 lbs. to the foot, and having a 16 in. × ⅝ in. top cover plate, and 14 in. × ⅝ in. bottom cover plate. The details of the construction are shown in the engraving. The girder carries the wall above it, and thus makes the machine and erecting shops practically one large room.

The details of the plant were worked up in the office of Mr. Garstang, Superintendent of Motive Power. The estimated cost of the shops is $100,000.

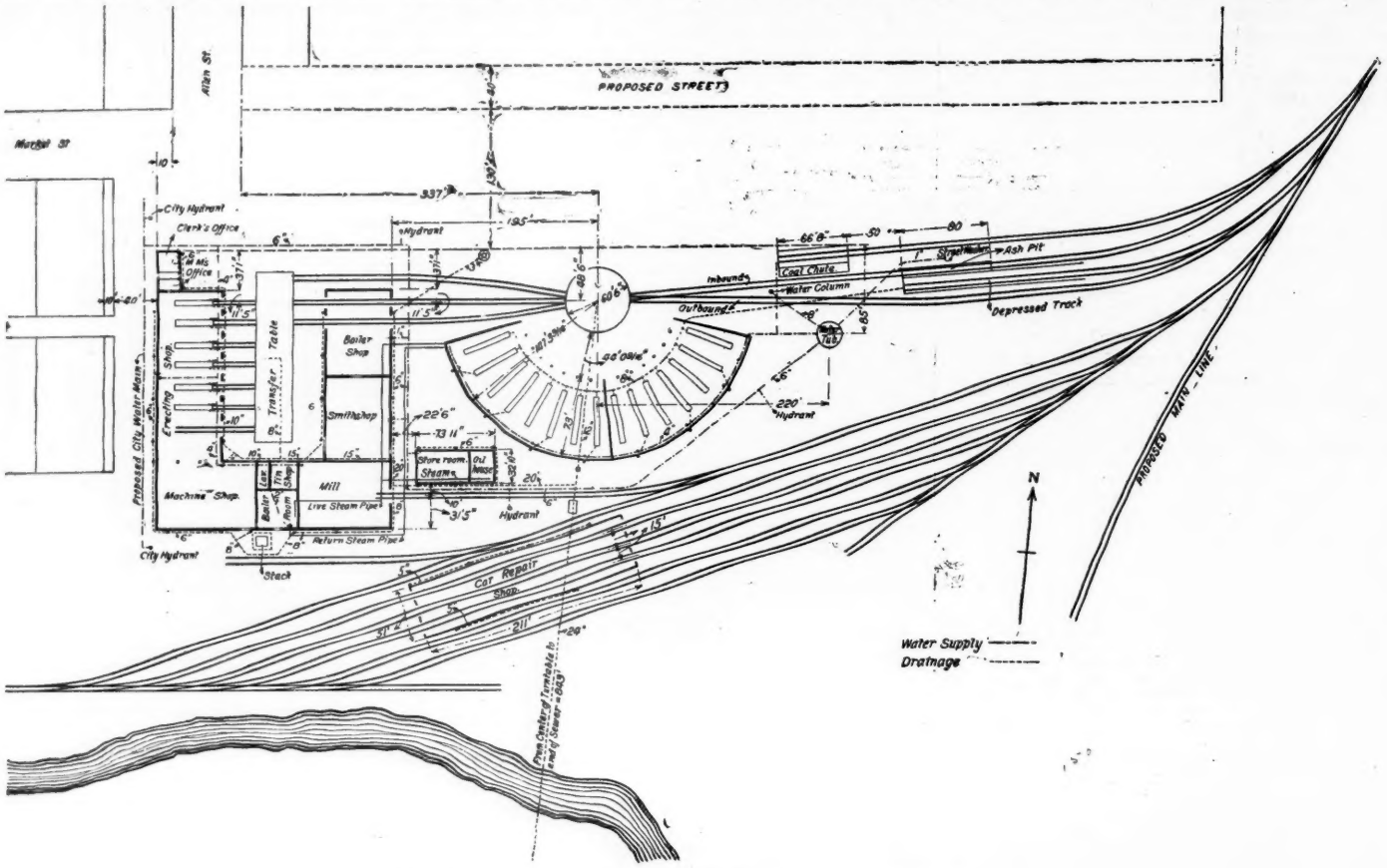


Fig. 1.—Plan of Shops and Yard, Showing Arrangement of Tracks.

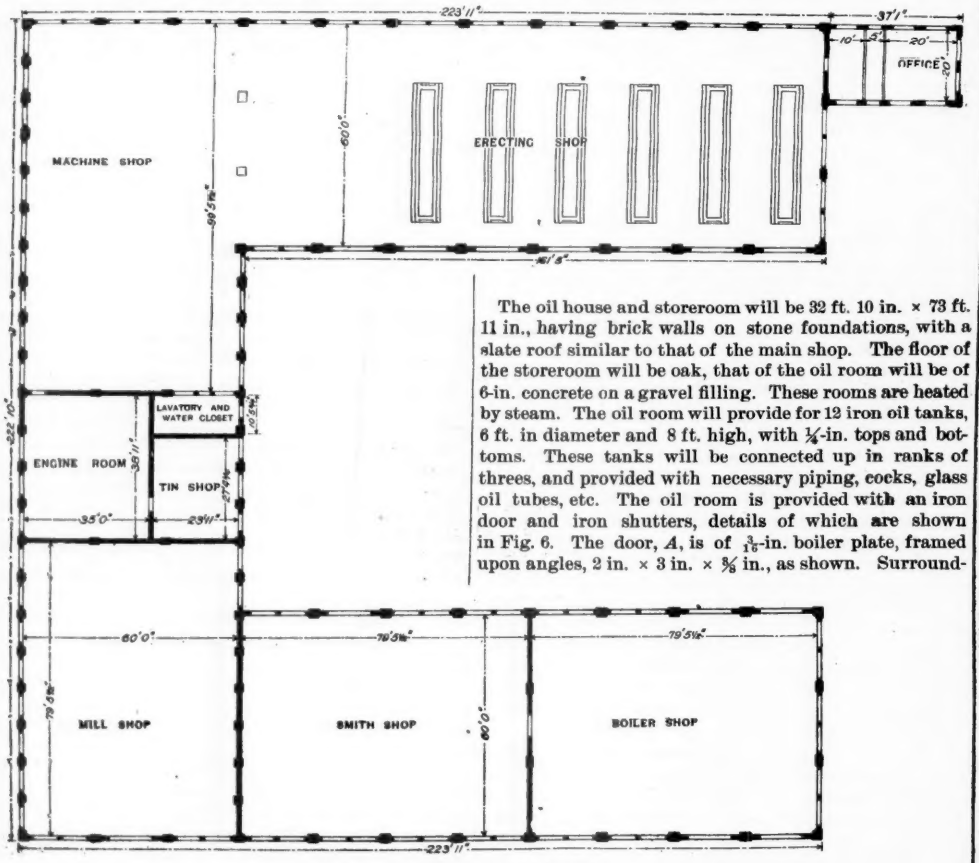


Fig. 2.—Floor Plan of Main Shop.

Each stall has a patent Roe smoke-jack of cast-iron with sliding sleeve, shown in Fig. 3.

In the detail drawings of the engine-house pit, shown in Fig. 5, *A* represents a cross section of the pit near its upper end. As will be seen, its sides are of rubble masonry 24 in. thick, to which the timbers for supporting the rails are bolted by ⅞-in. anchor bolts. The floor of the pit is of concrete, 4 in. thick upon 6 in. of sand. The 6-in. pipe shown in this section is the roof drainage

The oil house and storeroom will be 32 ft. 10 in. × 73 ft. 11 in., having brick walls on stone foundations, with a slate roof similar to that of the main shop. The floor of the storeroom will be oak, that of the oil room will be of 6-in. concrete on a gravel filling. These rooms are heated by steam. The oil room will provide for 12 iron oil tanks, 6 ft. in diameter and 8 ft. high, with ¼-in. tops and bottoms. These tanks will be connected up in ranks of threes, and provided with necessary piping, cocks, glass oil tubes, etc. The oil room is provided with an iron door and iron shutters, details of which are shown in Fig. 6. The door, *A*, is of $\frac{3}{16}$-in. boiler plate, framed upon angles, 2 in. × 3 in. × ⅜ in., as shown. Surrounding the door is an angle, 3 in. × 4 in. × ⅜ in. The iron shutter for the windows, of ⅛-in. iron, is shown at *B*. The oil room is also provided with three cast-iron bull's eyes.

The freight car repair shop, shown in Fig. 1, will be a frame building on rubble stone foundations. It will be 51 ft. × 211 ft., covered with a slate roof, provided with sky-lights, as shown in the end elevation, Fig. 7. Fig. 7 also shows the framing of the roof, which will be

The Substitution of Electricity for Steam in Railroad Practice.*

In this paper I shall consider electric traction as it stands at present, not the possibilities of the future. . . . The reports of the earnings of the railroad companies in the United States show that, after paying fixed charges, only a small amount of the net profit remains to be applied to dividends on the stock. Any general decrease in the earnings, even if it is only a small percentage of the total amount, will wipe out the narrow margin that is now applied to dividends, and the absorption by the electric lines of the local travel formerly conducted by the steam lines promises to do this. At first the managers of the larger steam roads ignored the growth of their electrical rivals, but the time has come when they can no longer ignore the decrease in the receipts from their local passenger travel, and they are beginning to face the difficulty and to carefully study the situation.

In this paper I will briefly take up the following questions:

1st. Given a railroad system at present operated by steam; Will it pay to change entirely to electricity, or to make a partial substitution, and how should the change be made?

2d. If entirely new lines are to be built, is it likely that it will pay to equip them electrically? How should they be equipped?

3d. I will describe the equipment of the B. & O. Tunnel plant and draw from it what morals I can.

In order that it should pay a railroad to make a change in its motive power the effect of the change must be either to increase the receipts or decrease the expenses by an amount equal to the interest on the cost of the change. There should, theoretically, be such a gain; practically, the amount would be greater in order to justify the change, to take into account those elements not capable of exact calculation, and also the fact that an increase in the fixed charges of a road is a more serious matter than the mere amount of it, for although the average for a number of years might show a gain by the substitution of electricity, in a bad year the increased fixed charge might cause difficulty.

* Address of Dr. Louis Duncan, President American Institute of Electrical Edgineers, before the recent convention at Niagara Falls.

There are two very distinct sides to the question of transportation, the passenger side and the freight side, and their requirements for good service are very different. First, taking the question of passenger travel, the receipts of a road are increased by running trains at short intervals and at high speeds, and this is a condition peculiarly favorable to electricity. On an electric line short trains equally distributed over the track give a greater station efficiency, and the lowest cost of equipment of both station and line. The cost of train service is somewhat greater, but is compensated by the saving in the other items.

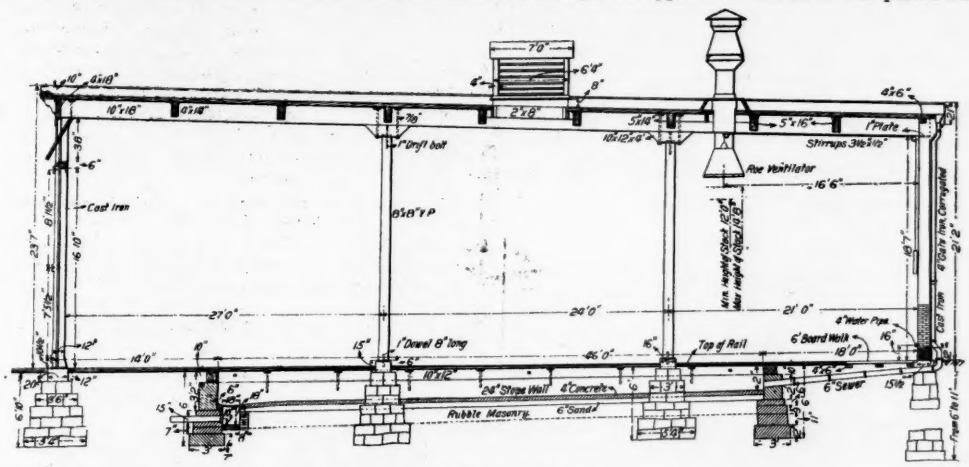


Fig. 3.—Sectional View of Engine House.

The cost of hauling a given number of passengers between given points by steam is greatly increased when the number of trains is increased, the efficiency is less, and the cost of equipment and of train service is greater.

On the other hand, if you take up the question of freight traffic, the conditions of greatest economy are reached when trains of a maximum weight are hauled by a single locomotive. The tendency in late years has been in the direction of increasing the size of the locomotive, the capacity of the cars and the length of the trains. The decreased cost per ton-mile for freight transportation has shown the wisdom of the change. On one of the larger roads which publishes careful yearly statistics, I find that the cost of transportation per ton mile in 1870 was 1.15 cents, and in 1890 .56 cents; on another road it was 1.9 cents in 1864 and .447 in 1893. The number of tons per train-mile on the first road in 1870 was 103, while in 1890 it was 226. In attempting to carry on traffic of this kind by electrical locomotives operated from a central station we find that we are at a great disadvantage because of the irregular service necessitated by the freight traffic and the unequal distribution of the load along the line.

Suppose, for instance, that there were two stations supplying the lines, and that the traffic was uniformly distributed along it, then the capacity of each station would be one-half of the total required capacity. Suppose, however, that the entire traffic was concentrated in one train, then each station would have to have a capacity equal to the total power required for hauling the entire traffic, as the train would be first supplied from one station and then from the other. The line also would have to have a capacity suitable for handling the total traffic. If a number of heavy trains were used, and the traffic was irregular and liable to be congested at one point, as in the case of freight service, then again the capacity of the station would have to be greater than that required to supply one-half of the normal traffic. If we were to decide to transmit the current to a longer distance and to supply all the track from one station, using transformer devices along the line, then the capacity of the station itself would only be that required for the normal traffic of the line, but the transformer devices would have to be sufficient to handle the maximum traffic of the section which they supplied.and would have to be given a capacity greatly in excess of the average load in order to supply this energy. We must distinctly bear in mind, in considering the application of electricity to steam roads, any departure from a uniform distribution of load along the line will increase both the cost of equipment and the cost of operation.

In looking over the reports of the same road from which I have given freight statistics, I find that in 1870 the receipts per passenger mile were 2.09 cents, while the the expenses were .59 cents. In 1890, the receipts were 1.9 cents, while the expenses were 1.47 cents. During this period passengers per train mile have decreased from 79 to 59. Comparing these figures with those given for freight transportation, we find that the two types of traffic have gone in opposite directions in the period which we have been considering. The amount of freight transported per train-mile has more than doubled and the expense has decreased more than one-half. The passengers per train-mile, on the other hand, have decreased and the expenses have changed only a slight amount, notwithstanding the great economies that have been put in force in the interval. Passenger traffic has come in the direction in which electricity is the most economical for transportation; freight traffic, on the other hand, has gone in the direction where electricity becomes most costly

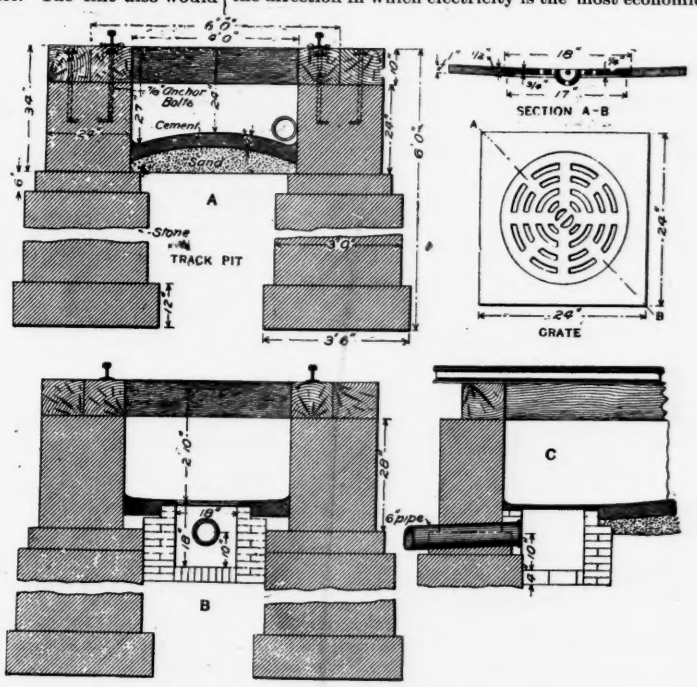


Fig. 5.—Engine House Track Pit Sections.

In Freight Service.—It might be argued that some new scheme for freight transportation by electricity might be used, but it would be difficult to devise any system more economical than that at present in use, and the great amount of through traffic on freight lines precludes the possibility of devising any system which differs radically from that at present in use. For instance, taking the figures from the records of the Pennsylvania Railroad for 1893, I find that the freight mileage of foreign cars on the Pennsylvania road east of Pittsburgh is in round numbers $370,000,000, while the freight mileage of home cars is $436,000,000, making almost 46 per cent. of the total mileage made by foreign cars. It would seem, then, impossible to change the present system of freight traffic without disorganizing the service and decreasing the freight revenue of the road. The importance of freight traffic is shown by the fact that the earnings from freight on all the roads in the United States is between two and one-half and three times as great as that for passenger traffic.

Suppose, then, the question comes up before the managers of a road as to whether they are to equip their lines to be operated entirely by electricity. It seems to me, as matters now stand, it will not pay trunk lines to change the method of operation for freight traffic, and the question to be considered would be the operating of the lines partly by steam and partly by electricity. Let us consider if it is possible to run the passenger service wholly or partly by electricity.

In Passenger Service.—Considering a two-track road doing a through as well as a local business, I think we can decide that unless the case be an exceptional one, it will not pay to equip the main line electrically. It is necessary that the through express service be continued, and that the freight service be continued, and an attempt to operate the local trains with the through trains could not be successful if there was any considerable amount of through traffic.

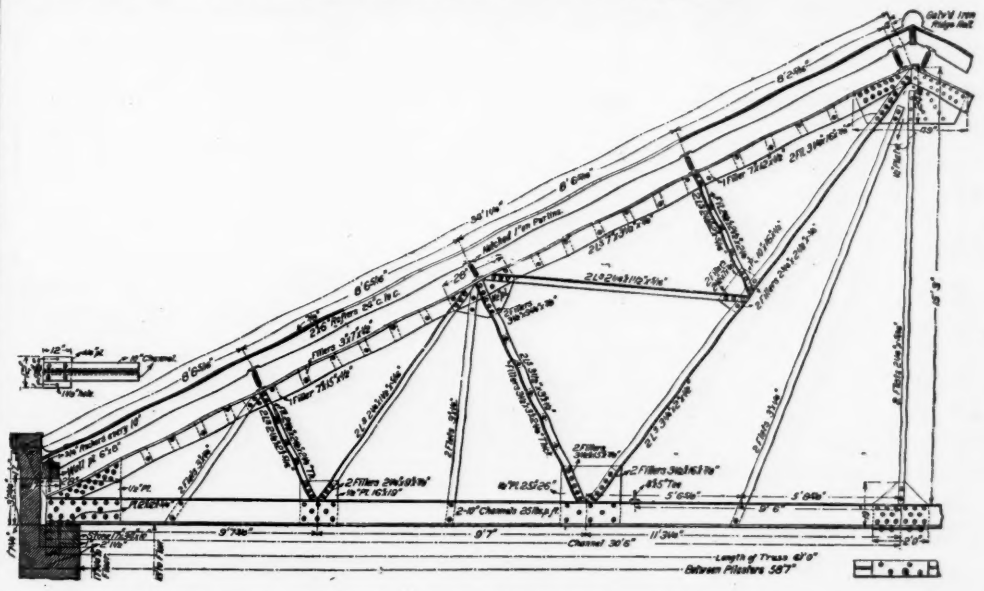


Fig. 4.—Plan of Roof Trusses for Blacksmith, Boiler and Erecting Shops.

With a four-track road the condition of affairs is somewhat different. If the road operates between cities acting as terminal points for all passenger traffic, as with some of the lines between Boston and New York, then by equipping all four tracks it would be possible to run express service at short intervals on two of the tracks, and on the other two tracks to run freight and local trains. At present it would not pay to use electric locomotives operated from a central station for the freight service, but the local service could be operated electrically, and as the speed of the local trains would be approximately equal to that of the freight, there need be no serious interference with the traffic. We would then have express passenger service working under favorable conditions, that is, with a number of trains evenly distributed; a local service operated under similar favorable conditions and with no interruption to the freight traffic. If the road, however, is to transport a considerable number of foreign cars, as, for example, the New York Central or the Pennsylvania Railroad, then the condition of affairs for express service would not be so favorable, and the question of the equipment of the tracks for express service would have to be carefully considered.

As far as the branch lines go, whether it would pay to partially or wholly substitute electricity for steam, depends upon the local conditions. A long branch with a small amount of local traffic, it would not pay to equip, but on a short branch with considerable passenger traffic and comparatively little freight traffic such equipment would pay. I find that in 1892 the total number of through passengers carried by the New York Central Road was 234,650, while the number of local passengers was 21,978,979. It will be seen that the through traffic is but a small percentage of the total number of passengers, and that the question of preserving the local traffic is of great importance. Now the greater part of this local traffic will in the next few years be taken by the electric roads paralleling the steam road unless some effort is made either to control the electric roads or to give an equally good service between adjacent towns. This latter is possible, using the ordinary steam tracks only when the distances between towns are small and the amount of freight or through traffic is also small.

There are certain kinds of local traffic which the steam roads must, to a large extent, lose, and which in the nature of things they cannot regain. In large cities having a considerable suburban traffic the trolley roads, forming, as they do, a network of lines within the city and extending in every direction into the suburbs, offer advantages with which the steam roads cannot compete. In Philadelphia one of the large steam lines lost so much traffic that it has attempted to regain it by reducing prices and increasing the number of trains. In this effort it has partly succeeded, but at the cost of greater expense and decreased receipts. To counterbalance this

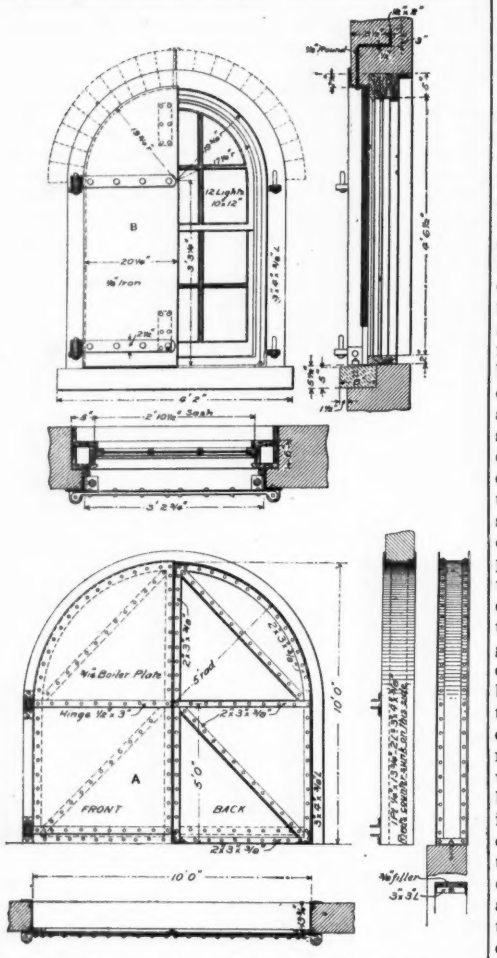


Fig. 6.—Details of Iron Door and Window Shutter for Oil House.

loss at central points railroads may hope, by the introduction of electricity, to increase their earnings along the lines and their branches.

The Equipment Required.—As to the nature of the equipment that will be required, it would depend on the work to be done and the branch that is to be equipped. In some cases it might be well to use single electric cars running on the steam tracks between towns and on the local tram lines in the towns. As the speed would be very different in the town and on the railroad line, and as the voltage could also be different, it would be well in this case to use a number of motors on the car, and to use a series parallel controller, the motors being in series for the town traffic. For instance, suppose we wish to run at a maximum speed of 40 miles per hour between two towns, and it is economical to use 1,000 volts on the line, we could use two motors on the car, run them in parallel on the main line at a speed of 40 miles per hour, while in town, with a voltage of 500 we could run them in series at a speed of 10 miles per hour. I can hardly imagine a case where the three-wire system could be economically used for such service on the steam lines.

The condition of affairs in electric transportation is at present curious. The trolley companies, by extending their lines, are working from tramway transportation to through transportation. They are attacking the problem by development from small motors to larger ones. The railroad companies, starting with the large units, are coming down in the direction of the present trolley systems. Perhaps in the future they will meet and some standard electrical system will be adopted for the present steam road. I think, then, that in the case taken up, the policy of the road will be to equip those branches for which the conditions are favorable with a trolley, run comparatively large motor cars capable of drawing one or two ordinary passenger or freight cars as trailers, using the present steam service for their freight traffic when necessary. This will allow the necessary through travel, will give the required local service between towns and will not interfere with the freight traffic.

As for the systems to be used for such services, I believe that at the present moment the continuous current overhead trolley system is the only one that can be selected with a certainty of successful operation. It gives a minimum complication in the way of conveying the current to the cars, it allows a considerable range of speed with a comparatively high efficiency, and our experience with it is such that successful operation could be at once guaranteed. By using different voltages in the towns and on the line, both high and low speeds can be obtained. If the line to be operated is to be very long, it might be best to use rotary transformers at different sub-stations along it, the line being supplied by continuous currents from the sub-stations. In fact, the three systems that are at present possible, are: first, the ordinary direct current system; second, a system in which direct currents are used on the line and rotary transformers supplied by alternating currents are placed along it; and third, a two or three-phase system supplying rotary field motors on the cars. In the latter case, it would be well to employ different periods in the towns and on the lines.

The second case which I wish to consider is that of roads built for an entirely new electrical equipment, such, for instance, as the elevated roads in Chicago and the underground rapid transit road in New York, or the proposed Washington-Baltimore Boulevard Line. In most of these cases the traffic is almost entirely a passenger traffic and the conditions are especially favorable for the operation of electricity. Taking first the case of the New York underground road, there will probably be required about 150 trains for local service, each train having five ordinary cars and a motor car. For the express service there would be about 25 trains of say four ordinary cars with a motor car. For this it would probably be best to use the direct current, three-wire system, one of the cars on the train being equipped with motors and acting as a locomotive. With four motors on a car the system would be efficient at all practical speeds, and, if desired, a large part of the energy could be thrown back on the line when the cars are being stopped. In the case of the local trains a simple calculation will show that a very small part of the total energy expended is used in overcoming the track resistance, while a very considerable part is employed in accelerating the train and afterward wasted by braking. I have calculated the amount of energy which can be practically saved under the conditions of local and express traffic on the New York underground road and find that with motors of ordinary efficiency about 45 per cent. can be returned. If storage batteries are used in connection with the central stations, the batteries being located along the line, a uniform load can be thrown on the stations, and their capacity may be reduced to almost one-half as compared with a system in which the energy is not returned, thus greatly decreasing both the expense of installation and of operation. As it is possible at present to obtain batteries with a rapid discharge rate at very reasonable prices and with a guarantee for repairs that places them well within the limit of commercial calculations, a system of this kind offers some advantages over any other system that could be applied to the operation of the underground road. An alternating current would hardly be economical for this work, as it precludes the possibility of returning the energy to the line, and as the variable speed required makes it uneconomical as compared with the direct current system using, say, four motors with series parallel control. In the case above cited, shunt motors would be used, and it would be possible to get a contact with the line that could not under any circumstances be broken. The case of the elevated roads is very similar to the ones I have cited except that in existing structures shorter trains would be used, and the cost of equipment for a given number of cars would be somewhat greater.

The Lessons of Baltimore.—Baltimore has been the pioneer in almost every branch of transportation. In ocean service, the record of the Baltimore clipper is a tradition of our maritime supremacy. The Baltimore & Ohio Railroad was the pioneer steam road. An electric road from Baltimore to Hampden, built in 1885, gives us a right to boast of our pioneer work in electrical tramways. The immense locomotive for the Baltimore Belt Line tunnel is the first instance of the direct displacement of steam by electricity, and the line over which it is to be operated is the first through steam line to be equipped electrically. The Baltimore &Columbia Railway Co. owns in Washington the Eckington & Soldiers' Home Railroad and the Belt Line railroads, and has franchises for extensive additions to their present mileage. In Baltimore they are constructing a road in the city and beyond it to Ellicott City, and they have also purchased a steam line running from Baltimore to Catonsville. They have rights of way from the terminus of their Baltimore lines to the lines they own and are preparing to build in the District of Columbia. The problem offered is not a simple one, but it is one of the most attractive that can be presented to electrical engineers. Speeds of 60 miles per hour are to be used for the cars outside the city limits, and within the city limits ordinary speed is to be employed. In the District of Columbia the overhead trolley cannot be employed. In fact, there is presented almost every problem which must be solved if electricity is to displace steam in the future with the same rapidity that it has done in the past. I think this road will be the first to solve the detailed problem of interurban rapid transit.

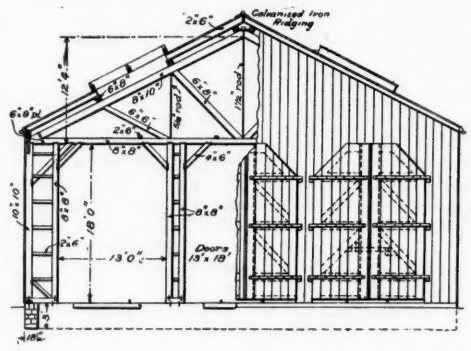


Fig. 7.—End View of Freight Car Repair Shop Showing Framing.

The last subject which I wish to take up is the electric plant for the Belt Line tunnel of the B. & O. railroad. In this case there is no question of economy in the employment of the electrical locomotives, as the plant adds considerably to the cost of operating the road. . . . The total length of line equipped is about three miles, the extension beyond the tunnel being for the purpose of assisting the freight locomotives to haul their trains up the one and one-half per cent. grade on the line beyond the tunnel. There are to be three locomotives, and it is calculated that the traffic can ordinarily be handled by two of them. The steam engines are not to be taken off the trains, but hauled through the tunnel by the electric locomotive which switches off at the terminus of the line. To operate these machines the station has been erected which contains 3,000 H. P. of electric generators, and an overhead line has been equipped to transmit current to the locomotives. With respect to the station itself there is little that is novel. There are four 750 H. P. Allis-Corliss engines directly coupled to generators of the same capacity, the generators having a voltage of 600 at no load and 700 at full load. Foundations have been partly erected for a fifth unit in case it is found necessary. The building also contains the lighting plant, having a capacity for 400 arc lights and 4,000 16 c. p. incandescent lights. Provision has also been made for an extension to this lighting plant when the stations for the belt line are erected. There are two incandescent machines, and one of them will be used to supply the 1,000 32 c. p. lamps which have been installed in the tunnel.

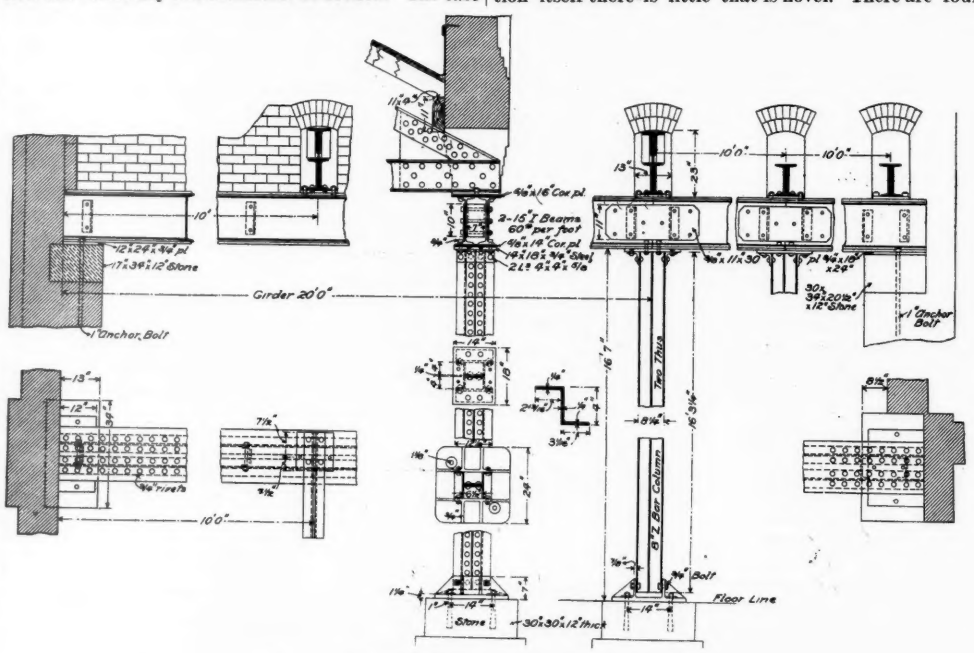


Fig. 8.—Details of Girder and Column Construction.

Perhaps the most novel feature of the plant is the overhead structure which is employed. The conditions to be met were peculiarly difficult, and the ordinary under trolley was considered impracticable. The tunnel is very low in places, and the management of the road decided that the conductors could not be placed over the cars but should be placed in the middle of the tunnel between the tracks. Outside the tunnel the conductor is still between the tracks, but is elevated to a height of 22 ft., while inside the tunnel it is only 17 ft. from the top of the rail. The conductor consists of an iron trough made of two Z bars riveted to a cover plate 12 in. wide, leaving a slot 1 in. wide between the Z bars. In the tunnel this trough is supported from transverse channel bars secured to expansion bolts, which are fastened from the top of the tunnel. There is a double insulation, one porcelain insulator being between the channel bars and another between the channel bars and the expansion bolt. Outside the tunnel the trough is supported as follows: At distances of 150 ft. light iron columns with cross trusses are erected, and between these trusses are hung catenaries supplied with a number of suspension bolts. Transverse channels similar to those used in the tunnel are fastened to these bolts and the trough is fastened to the channels. The Z bars are made in lengths of 30 ft., the opposite bars breaking the joints with one another, the lengths being riveted together and then bonded with "Chicago" rail bonds. Suspended on the same transverse beams as the trough are three copper cables of 1,000,000 c. m. area, which serve as feed wires, which are connected at intervals with a trough, there being, of course, one truck for each track. For the return circuit the tracks are bonded as in ordinary railroad work, there being cross bars and at intervals connections with a copper cable of 1,000,000 c. m. area in a wooden trough between the tracks. The contact arrangement that is to be used consists of a brass shoe traveling in the trough and connected with the locomotive with a flexible sawbuck arrangement which has a very considerable range in every direction. The current is transmitted to the motors by a copper cable, and in case of the shoe sticking in the trough, a safety pin is arranged to break with any desired strain. Where switches are used there is a tongue worked by the lever which operates the track switch, and which serves to direct the shoe. This structure promises to give an excellent contact at all times, and it requires no care from the motorman.

The locomotives are the most massive in the history of either steam or electrical transportation, and the weight, which amounts to 95 tons, is on eight driving wheels, so that the full tractive power of the locomotive will be developed. On each axle there is sleeved a six-pole motor, there being considerable play between the axle and the sleeve, which latter is spring supported from the frame. In this way any heavy blow due to irregularity in the track is taken through the springs, and the wear both of the track and locomotive is reduced. On the armature shaft are projecting arms which move between lugs cast on the wheels, thus allowing the necessary relative motion between the axle and armature.

If this equipment proves successful it will open a limited but important field for the introduction of large electric locomotives. There are in the United States a number of tunnels whose operation is anything but satisfactory at present which can be equipped as the Baltimore tunnel is equipped. Several of them have the additional advantage that they are near the switching yards of the roads, and the same plant could be used for hauling trains through the tunnels and for switching and not only would the economy of the station be increased, but the substitution of electric for steam switching engines would result in a very considerable saving.

Conclusions.—In this paper I have not indulged in prophecy, nor have I imagined any apparatus or equipment which cannot be bought in the open market. But to me it seems that the present is a crisis in the history of railroading. Up to the present the steam roads have ignored the competition of electric roads, or they have fought them. To-day they cannot afford to do either. In a few years electric roads will have absorbed practically all of the local traffic, and will begin to cut into through transportation. The steam roads cannot afford this. Their only safety is to make of electricity an ally nstead of an enemy, and this before it is too late.

The conclusions that I finally reach are these:

1st. The tendency of passenger transportation on the steam lines has been in the direction of the greatest electrical economy, while the tendency of the freight transportation has been in the direction of the least electrical economy.

2d. It will not pay any through line with considerable traffic, having two tracks, to equip their main tracks electrically.

3d. With four-track roads, it will pay to equip all of the tracks electrically, unless a considerable portion of the business is through passenger traffic.

4th. It will pay all the larger roads either to equip a number of their branch lines electrically or to control competing electric lines.

5th. In order to remain on a dividend paying basis, it is imperative that most of the two-track lines either build additional tracks or control the electrical roads that parallel them.

6th. Believing that ultimately all of the traffic will be done by electricity, it is imperative that the managers of steam roads keep constantly in touch with electrical progress.

Electrical Engineers' Convention.

The American Institute of Electrical Engineers held its twelfth general meeting at the Cataract House, Niagara Falls, June 25 to 28, with an unusually large attendance. The opening session Tuesday morning was called to order by the Secretary, who read a letter of regret from the retiring President, Edwin J. Houston, of Philadelphia, and then introduced the incoming President, Dr. Louis Duncan, of Baltimore. The morning session was taken up by papers by Charles P. Steinmetz and Clarence E. Gifford. In the afternoon the power house of the Cataract Construction Company was visited. This massive building has been a secret chamber for so many months that the greatest interest was felt by all in the first public test. One of the great generators was run at its full speed of 250 revolutions a minute. The immense machine ran as smoothly as a toy top, although it consists of a thick shaft 140 ft. long, at the bottom of which is the most powerful turbine of its size ever built and at the top of which is the largest generator in the world. The test was very successful, the machine developing 5,025 H. P., although using but a twentieth part of the total water power available. The power plant of the Pittsburgh Reduction Company was next visited and some time was spent in an inspection of the works of the Carborundum Company and the Niagara Falls and Buffalo Electric Light and Power Company.

The evening session of Tuesday was opened by the inaugural address of President Duncan, an abstract of which is published in another column.

It has not been the custom of the Institute to permit discussion of the inaugural address of the President, but Dr. Duncan's remarks were of such great interest that it was deemed advisable to throw the address open for discussion by the members.

Mr. Steinmetz opened the discussion by calling attention to the different methods of operating motors for railway work and of their respective limitations. The several classes of service he mentioned as follows:

1. City Surface Roads.—This field is now almost completely and satisfactorily filled by the continuous current motor operated from trolley lines at 500 to 600 volts, and at present no method is in view to replace the continuous current motor and overhead trolley, except in very special cases.

2. City Elevated Roads.—Here the conditions of service are very particular, the motor never operating at full speed, but accelerating and stopping again before full speed is reached, due to the frequency of the stations. This makes the continuous current series motor preferable to the alternating system, the more as the heavy traffic and comparative shortness of road does not offer any special advantage for the alternating system. Thus this field will be filled exclusively by the continuous current motor also.

3. Suburban and interurban roads, that is, roads running far out into the country or connecting nearby cities.—Here direct feeding by continuous current is excluded, and either continuous current motors are to be used, fed by rotary converters from high potential alternating lines or directly alternating railway motors. The first system, that of using rotary converters, offers the advantage that the same cars can be run over the continuous current city lines. The alternating motor has the disadvantage of requiring a double trolley, but the advantage of greater stability, due to the absence of commutators, easier control and no limitation of the voltage, the main current entering the stationary motor field only. Besides, the stationary transformer is very much more reliable than the rotary converter, which, as revolving mechanism, requires more or less attention. Thus, wherever it is not absolutely essential to run the same motors over existing continuous current city lines, alternating railway motors will be preferable.

4. Long distance traffic between capital cities at very high speed.—Here at present the electric motor can find an application if it offers what the steam locomotive cannot give, that is, very high speed. Such roads will operate at something like 100 miles an hour average speed, with a maximum speed of 120 to 150 miles. Obviously, continuous current motors are excluded from this service, and only alternating motors with high potential main lines can be used.

The objection raised against the alternating motor in former times, that it had no starting torque, no longer holds. A record of a standard car equipment with two three-phase induction motors, of the same power and the same size as the standard G. E. 800 H. P. shows the maximum drawbar pull, produced by the motors when connected in series control, for operating at half speed, of 2,000 lbs., and in parallel control 3,000 lbs., while in emergencies a drawbar pull is available of something like 6,000 lbs., far in excess of what will slip the wheels. Obviously, such excessive pull will be permissible for a limited time only, the currents being beyond the safe heating limit of the motors. The diagrams of the test show, however, that any drawbar pull which can be required, is given by the modern alternating current motor.

MR. OBERLIN SMITH agreed in the main with Dr. Duncan, but preseted arguments to show the adaptability of electric motors to freight trains. We need not wait until a speed of 100 miles an hour is demanded before beginning to compete with the steam locomotive for long passenger runs.

The President's address was followed by the reading of a paper by Prof. Elihu Thomson on Compounding Dynamos by Armature Reaction. On Wednesday morning Prof. Francis B. Crocker read a paper on Electric Power in Factories, which was discussed at some length.

ELECTRIC POWER IN FACTORIES AND MILLS.

A paper with the above title was presented by F. B. Crocker, V. N. Benedikt and A. F. Ormsbee. The subject has attracted much attention of late as being one of the important problems toward which the attention of engineers is now being directed. A number of tests of various punch presses, drills, lathes, etc., singly and in groups, are tabulated, which show that the power required to drive machine tools has been considerably overestimated. In the majority of the tools tested the motor was not more than one-half loaded, and in these cases it was seldom that the load equalled the full power of the motor even for an instant.

In the conclusions reached, the generally accepted greater first cost of electric installation is questioned by the authors. In their opinion the electric system would be cheaper than other systems; for instance, in the case of long or scattered buildings, or those containing many stories or rooms, in any of which cases belting and shafting would be very expensive, as would also be the necessarily stronger construction of roofs and ceilings. Concerning the saving of power the authors think it greater with electric transmission because of the high efficiency of the dynamo and motor as compared with the efficiency of belt transmission as ordinarily practiced, and further from the fact that consumption and energy entirely ceases when the tool stops. Increased output is secured by greater convenience and promptness in starting and stopping, and also in regulating the speed of the machinery. Convenience of moving tools is also secured, it being possible to place them in any desired position with reference to the work. Concerning speed regulation the paper concludes that the simple arrangement of varying the speed by means of a rheostat in the armature circuit answers very well in most cases, but for widely varying speeds a series wound motor controlled by a rheostat, as in electric railway practice, may be preferable. In other cases some special method of regulation may be adopted.

Mr. P. C. Steinmetz followed with his paper on Some Features of Alternating Current Systems. Next came papers by Prof. Dugald C. J. Jackson and S. B. Fortenbaugh, of Madison, Wis.

Wednesday afternoon was pleasantly passed in an excursion trip over the entire length of the Niagara Falls Park & River Railway and an inspection of the power plant of that road. At the evening session Dr. Charles E. Emery of New York presented a paper on "The Cost of Steam Power."

THE COST OF STEAM POWER.

Dr. C. E. Emery presented a paper on the cost of steam power, which was, as a matter of course, carefully studied and excellently presented. One is sure of this in Dr. Emery's work. We give only the chief results arrived at. This paper was prepared in answer to the question: "What would be the cost of steam power if supplied in large units and generated with modern machinery of the most approved type?" a question which has resulted from attempts, such as that at Niagara, to supply power, by means other than steam, at low cost.

The conditions involve far more than mere cost of coal and labor. The cost of coal is for ordinary engines of moderate size only about one-third of the total cost of steam power, so, if the other costs remain nearly constant, moderate savings in the cost of coal will not proportionally decrease the cost of the power. The decrease in labor depends largely on the size of steam unit it is found practicable to employ.

It is desirable to make the units of such size that one or more can be grouped to carry the load at any time without either overloading or greatly underloading either of such units. In a large plant, upon which presumably many different manufactories depend for power, there should be a spare unit which can be used in case of accident and ordinarily employed in regular turn so that all the machinery can be kept in repair.

The average cost per H. P. when the load is variable is considerably greater than if the power be furnished continuously. Coal is wasted in building up the fires and in caring for them when not required, all supplies are increased from the necessity of starting new after every stoppage, and there is an important loss due to the interruption of the regular hours of labor. The following table has been prepared to show the cost of steam power per H. P. under conditions: first, of maximum demand of 20,000 H. P. every hour in the year; second, with a variable demand, maximum 20,000 H. P. and average 12,760 H. P.; third, 20,000 H. P. continuously for 10 hours per day for 309 days in the year.

The cost of coal in column *A* is derived simply by multiplying the net power, 20,000 by 1¼, the coal per indicated horse power, adding ½ to allow for friction, and multiplying the result by 8,760, the number of hours in the year, and $0.001, the price per pound. The next item, that of labor, is made up as follows:

One attendant for each 2,500 H. P. engine, or 8 men in all, at 25 cents per hour	$2.00
14 firemen and 3 additional men at the same pay to care for pumps, etc., and to keep the premises clean; total, 17 men at 20 cents per hour	$3.40
Total cost of labor per hour	$5.40

To this is added $1.50 per hour, for engineering and clerical force. The cost of repairs is taken at 0.6 mills per H. P. per hour.

The cost of coal is for column *B* made up as follows: 15,000 H. P. of boilers out of 20,000 must be shut down daily for periods varying with the demand, and it is considered that it will require an amount of coal equal at

least to the average consumption for one hour during regular operation, to maintain banked fires, overcome radiation, and bring the fires to average working condition when they are again put in operation. The total daily horse-power hours is therefore increased 15,000 and multiplied by 309; the horse-power hours for the 56 holidays are then added to the same; the sum multiplied by 1.25 lbs of coal per horse power and by one mill per lb. and ½ added to the whole for friction, which gives the result in the table. The labor is:

Cost of labor per year	$34,512
Cost of superintendence per year	13,140
Total for labor and superintendence per year	$47,652

The cost of supplies and regular repairs will be somewhat greater proportionally than for continuous operation, and is estimated to be 70 per cent. of the similar costs given in column *A*, $105,120 × 0.70 = $73,584.

	A. 20,000 H. P. each hour of year.		B. 29,000 max. H. P.; 12,760 average.		C. 20,900 H. P. 10 h. per day, 309 d. per year.	
		P. c. of total cost.		P. c. of total cost.		P. c. of total cost.
Yearly cost of coal	$237,250	43.4	$157,644	37.3	$92,056	30 6
Estimated cost of labor	60,444	11.1	47,652	11.3	27,198	9.1
Estimated cost of supplies and regular repairs	105,120	19.2	73,584	17.4	37,080	12.3
Estimated interest, insurance, taxes and cost of renewals	144,000	26.3	144,000	34.0	144,000	48.0
Total	$546,814	100.0	$422,880	100.0	$300 334	1 0.0
	Per H. P.		Per H. P.		Per. H. P.	
Cost of steam power per H. P. per year	$27.34		$33 14		$15.17	Here 75 cts. is added for general expenses, instead of $1, as in the two previous cases.
Cost of steam power per H. P. per year, if 5 per cent. of the original cost of plant be charged for dividends and $1 per H. P. added for general business expenses	31.94		37.74		19.52	
Cost of steam power per H. P. per year if 10 per cent. of the original cost of plant be charged for dividends and $1 per H. P. added for general business expenses	35.54		41.34		23.12	

The yearly cost of coal in column *C* is obtained by computing the coal for 11 hours per day, and making the calculations as for column *A* for 309 × 11 = 3,399 hours in the year. The labor would be occupied 309 working days, and, say, one-half the holidays. The cost of labor for 337 days of 10 hours or 3,370 hours, at $5.40 per hour, =$18,198. Two assistant engineers could be dispensed with, thus reducing the cost of superintendence to, say $9,000 per year. The sum of these two quantities is given in the table, column *C*. The cost of supplies and repairs is estimated at the rate of 0.6 mill per horse-power hour, 20,000 × 3,090 × $0.0006 = $38,080.

On Thursday morning Dr. Albert M. Bleile read a paper on the Cause of Death in Electric Shock. Mr. George H. Winslow, of Pittsburgh, presented a paper on "Long Distance Power Transmission at 10,000 Volts." His example was the Pomona, Cal., plant where long distance transmission has proved very successful. An abstract from it follows:

LONG DISTANCE TRANSMISSION AT 10,000 VOLTS.

This paper is by Mr. George Herbert Winslow. It is a complete and very interesting account of the electric installation for the San Antonio Light and Power Co., of Pomona, Cal., which plant has been referred to before in these columns. The plant has been in operation for more than two years and is used to transmit energy from a waterfall in the San Antonio Creek to sub-stations at Pomona, 13¾ miles distant and San Bernardino, 28¾ miles distant, from which points it is distributed for incandescent and arc lighting. It consists of a Pelton water power plant and a Westinghouse alternating-current transmission plant in which generators supply currents to sets of raising and lowering transformers, operating at 10,000 volts and delivering current to the local circuits at 1,000 volts.

One of the most interesting features of the plant is the means used for regulating the speed of the Pelton wheels so that it may be constant under varying loads. This is usually done by throttling the water. In this case two tapering cast iron pipes are bolted to the lower side of the steel receiver which terminates the pipe line, at an angle of 30 degs. These pipes conduct the water to the under sides of two independent Pelton water wheels which drive an alternating current generator and its exciter. The flow of water from each pipe can be completely controlled from the dynano room by means of the gate valves placed in each. For regulating the speed of the Pelton wheels, however, the pipe running to each wheel is provided below the valve just mentioned, with two nozzles cast in one piece and attached to the valve by means of a limited ball and socket joint. By defecting the nozzle by means of this ball and socket joint the speed of the wheel is regulated as required. This deflection is automatically accomplished by means of a Pelton differential governor. A set of tips of different diameters is supplied with each nozzle, so that the size of the jet used may correspond to the maximum load and thus unnecessary waste of water be avoided.

A power station was built to accomodate four 120 K. W. 7,200 alternation, 12-pole, single phase, Westinghouse alternators with the necessary raising transformers, switch board and exciters. The sub-stations at Pomona and San Bernardino are small brick buildings one story high containing lowering transformers which reduce the 10,000 current to 1,000 volts. The distribution from both sub-stations is effected in the usual manner at 1,000 volts for incandescent light, the only point of interest being that a considerable number of Helios arc lamps are successfully used on the circuits. The paper includes a number of interesting efficiency tests of the two circuits.

The afternoon was spent in individual trips to the various points of interest at the Falls. Most of the guests of the Cataract House accepted the invitation of the Institute to attend the evening session. Dr. Coleman Sellers, the engineer of the Niagara Falls Power Company, and Mr. L. B. Stillwell, the expert engineer and assistant manager of the Westinghouse Electric and Manufacturing Company, read interesting papers describing the power project at the Falls. These papers were illustrated with stereopticon views, and gave a very thorough exhibit of the construction and operation of the turbines and dynamos and the generating of large units of electricity. At this session the paper of Mr. Franklin L. Pope on the reconstruction of a small central station plant was read. The last paper of the meeting was by Mr. W. L. R. Emmet, on Existing Commercial Applications of Electrical Power from Niagara Falls.

The Electrical Accumulator.*

This subject is receiving greater consideration to-day than ever before. Under the present systems of generating and distributing electrical power there is a great waste, and if this wasted energy can be held in storage until actually needed, there will be a great saving.

We have at our New York terminal a main battery of 70 cells of the chloride type C 3, and two cells of type E 7 for locals; prior to the installation of this plant, which was about Oct. 1, 1894, we had two banks of main battery of the gravity type, one of 140 cells, another of 50 and also 48 for locals. These batteries required a room 12 × 12; our present main battery of 70 cells is kept in a closet 5 ft. long, 4 ft. high and 10 in. deep, and located in the dynamo room. Each cell has a nominal capacity of 12½ ampere-hours, with a nominal discharge rate of 1¼ amperes and a pressure of a fraction over two volts. As our wires consume only .12 ampere-hour, we can carry our service five days without recharging.

In this battery there is no chance for the plates to buckle or the pastilles to get out of the plates and short-circuit the cell. It is fed from an arc light machine carrying 16 to 18 amperes, and a pressure of from 300 to 600 volts, according to the load; the feeding wires are simply "tapped" to the main circuit and the draught is regulated to about ½ ampere by means of incandescent lomps, connected in series, in the feeding circuit. Both terminals of the main battery are connected to the switchboard in the telegraph office, so that it is always available for use as an intermediate or for testing purposes. The distribution to the different circuits is regulated by means of lamps of various resistance, each wire having its own lamp or lamps, connected in series, to reduce the current to just what is needed for the proper working of each wire; these resistances absolutely prevent any interference as between wires connected to the same battery through the grounding of any particular wire.

All of our wires, with a mileage ranging from 1 to 451, are fed from this one bank of 70 cells, without any of the difficulties experienced with gravity battery.

The local cells—which have a capacity of 150 ampere-hours, with a nominal discharge rate of 15 amperes—are connected directly in series with the arc lamps, so that the total output of the machine passes through them. By means of a double-pole switch one local cell is always connected into the arc circuit for charging while the other cell is feeding the 21 sounders. Each sounder will consume about one-quarter ampere-hour when closed; at this rate the 21 sounders would about exhaust the cell every 24 hours if all remained closed; but it is fair to assume that two-thirds of the local circuits are open as much as they are closed, therefore the average is much less, and it is within bounds to place it at three ampere-hours per sounder per day. At this rate of discharge the local cell will carry the service for 2½ days; as a matter of fact, we were obliged to use them for five days without recharging, while our dynamo was being repaired.

The first cost of the chloride cell type C3 set up and ready for service is about $2, and for type E 7 about $10. The cost for maintenance of our gravity battery was about $1.65 per cell per annum, without considering the value of the room occupied by it; therefore it is obvious that the expense of maintaining our gravity battery for one year was more than enough to purchase the storage plant.

The cost for maintenance of this storage battery is nominal, say 10 per cent. for interest and depreciation, for there is practically no expense for charging—the amount of coal used is just the same as before the battery was put on, and the ammeter is not deflected when the battery is switched in or out—in fact, we cannot detect that the feeding of these cells has added anything to the load of the machine, which by the way, is rated to carry ten arc lamps, and it was carrying that number when the battery was connected, but since that we have put on an additional lamp.

It is asserted that the acid put in the solution, when the battery is first set up, always remains and only the water evaporates, therefore the only attention required is to keep the cells full of water and the connections well greased. An experiment is now being made to reduce the evaporation of water to a minimum by filling in over the top of the cell with wax. I cannot give you anything definite with regard to the life of this battery, but the manufacturers claim that if the discharging rate is kept within its capacity and the terminals kept clear of acid, it will last a number of years. The chloride accumulator is controlled by the company owning the Brush and other basic patents, which have been settled by the courts, so that there is no fear of a lawsuit for damages.

The storage battery will, undoubtedly, be the direct power used for operating the automatic block signals, which, I believe, all of the large railroads will adopt within the next few years; four to six cells of storage battery placed at each signal, and charged by generators placed at water stations, will furnish the power to operate the semaphore, which in my opinion, will be the type adopted as the standard signal.

Railroads having their own lighting plants will find the storage battery a very useful and economical adjunct. Take, for example, a plant wired for 100 lights; probably not more than 20 are used after 11 p. m., and yet the plant must be kept running all night to supply the 20 lamps. Now if we add to such a plant 58 cells of storage battery of the proper capacity, we will have power to carry 120 110-volt lamps while the generator is running, and the battery will furnish current to carry the 20 lamps after the machine has stopped, and at the same time feed your telegraph wires. It is, of course, understood the generator must be run a sufficient length of time to properly charge the battery, and, also, that if cells of larger capacity are used, the generator can be run by the shop engineer during the day to charge the battery sufficiently to carry the night service.

The latest statistics show that there are in Switzerland 161 storage battery plants, in connection with 740 lighting and power plants, and of the 116 new lighting plants established in 1893, 40 were equipped with storage batteries. In this country there have been a number of different kinds of accumulators tested and the majority of them failed. This fact, together with numerous lawsuits, has led people to the conclusion that the storage battery is expensive and unreliable; but I believe that the storage battery has passed the experimental stage.

* A paper read at the Montreal Convention of Railroad Telegraph Superintendents by Mr. J. B. Stewart, West Shore Railroad, Weehawken, N. J. (Condensed).

Construction of Telegraph Lines.*

It is difficult to speak favorably of telegraph lines, æsthetically considered, for they are always more or less unsightly, but their extreme unsightliness in many cases is due to careless construction and indifferent maintenance.... Our companies annually suffer great inconvenience and loss of money by reason of the lines giving way under the pressure of severe storms, but it does not seem unreasonable to assume that telegraph lines should not yield to wind and sleet storms more easily than other structures of a similar character.

Iron poles are used to some extent in Europe, Asia and South America, but in this country they cost three or four times as much as wooden poles. And there is the danger of having wires grounded by the poles in case they become detached from the insulator. Poles as a rule are either chestnut, white or red cedar, cypress, red wood, Oregon pine, and in some cases where an exceptionally high pole is desired, Norway pine is used. Poles should be of live, green wood, squared at both ends, reasonably straight, peeled, knots trimmed close, thoroughly seasoned, free from sap, and should be cut between November and March. If the wood is set into the ground when green with the sap in it, dry rot is sure to set in. In single pole line construction the circumference of the pole, regardless of its length, should not be less than 22 in. at the top. The circumference 6 ft. from butt, for a pole 20 ft. long should be 30 in., increasing from 1 to 3 in. for each additional 5 ft. in length.

General practice as well as experience would indicate that poles should be set at a depth about as follows:

Length of poles.	Depth.
20 and 25 ft.	5 ft.
30 " 35 "	5½ "
40 " 45 "	6 "
50 " 55 "	7 "
60 "	8 "

In European countries it is a common practice to prepare poles by impregnating them with preservative compounds, sulphate of copper, chloride of zinc, creosote, etc. So long as the price of poles does not exceed the present figures, we would hardly be justified in resorting to these measures; but an inexpensive means of preserving wood is suggested by a recent experiment made upon the hemlock sills of a shop. At certain intervals the sills are saturated with kerosene oil, and as a result the life of hemlock under such conditions has been double, and the sills are still in good condition. This would suggest that a hole be bored in each pole a few feet above the ground, having poured into it at certain intervals a quantity of oil, until the pole becomes thoroughly saturated.

There is a tendency to the use of unduly high poles. The shortest pole possible should be used under all circumstances, and especially on heavy trunk lines. The single pole with a number of cross-arms and wires suspended high in the air presents the features of a pyramid resting on its apex rather than its base. The height of lowest wires running parallel to the tracks need not be much over 10 ft, and at public road crossings 22 to 24 ft.

The principal strain upon telegraph poles is not in the direction of the wires which they support, but transversely; if this be true, it would be worth our wnile to study the advantages of double-pole construction.

In European countries the most common is perhaps the "A" pole, which consists of two poles slightly scarfed at the top and presenting the features of a cone with its apex at the top and resting on its base. The first cost in building the double-pole line may be slightly in excess of the single-pole line; some difficulty may be experienced in constructing double-pole lines along deep fills, in digging holes to the proper depth, etc., but I am inclined to think all these difficulties would soon be overcome by experienced men. The line and slant of poles from a tangent to a curve should change uniformly with the curvature. At each end of curves above three degrees two or three poles should be guyed or well braced, and every tenth pole on long tangents must be head guyed.

Mr. Taylor then went on to describe the best cross arms, with methods of construction, giving details of attachments to poles and how to paint the arms.

In the construction of a line the sag in the wire is an important factor. The form which a wire suspended between two poles assumes is approximately the curve called the catenary. The properties of this curve have been studied carefully by engineers. It is the curve which characterizes the construction of suspension bridges, and notably the Brooklyn Bridge. The less the sag in the wire the greater the strain. For at least ordinary conditions the following will serve us in illustrating the value of the sag: "Take one half the distance between the poles and square it; then divide it by twice the sag—all represented by feet; then multiply this quotient by the weight of a foot of wire." Following this rule, and

*A paper by Mr. W. F. Taylor, of the Pennsylvania Railroad, Altoona, read at the Montreal Convention of Railroad Telegraph Superintendents, June 12. (Condensed.)

supposing that the poles are 30 to the mile, and that the wire is of the kind known as No. 8 wire, we have this conclusion, namely:

When the sag is 2 ft., that is to say, when the lowest point in the curve is 2 ft. lower than a straight line drawn between the poles where the wire is attached, the strain in the wire is about 140 lbs. When the sag is 1 ft., the strain is about 280 lbs.; when the sag is 6 in., the strain in the wire is about 560 lbs.; when the sag is 3 in., the strain in the wire is about 1,120 lbs., and so on. If, as stated above, the wire is drawn up so that the sag is 6 in., the actual strain in the wire is nearly half the tensile strength, and it is very close to the limit of elasticity. We should not strain the wire in construction over 200 lbs.; but, according to present practice, it is perhaps s rained nearly double, or, in other words, the factor of safety is very small.

The expansion and contraction of material under the influence of heat and cold is, of course, a well-known physical phenomenon. Let us suppose that a telegraph wire is put up on a warm summer day, with the temperature 90 deg. Fahr. The wire is put up so that there is a sag of two feet between the poles; the poles being 30 to the mile. What will take place with the wire when the temperature becomes 10 degs. below zero, or a fall in temperature of 100 degs? Apply the coefficient of expansion for wire under these conditions. We find that the wire is shortened by the contraction about 1½ in., and that this shortening introduces a strain into the metal of about 550 lbs., and that the wire which originally had a sag of 2 ft. has now a sag of 6 or 7 in.; the total strain in the wire being nearly 700 lbs., or more than the elastic limit of the metal.

Some time ago we tested a series of joints in No. 8 iron wire and also tested one piece of solid wire. The joints were made in the usual way by our linemen, but were unsoldered. The tensile strength of the wire was 1,170 lbs. The unsoldered joints stood an average of 660 lbs.; all failing by the slipping of the joints, which unwound. soldered joints stood an average of 1,210 lbs., or, in other words, were stronger than the solid wire. These tests would indicate that unsoldered joints are perhaps the weakest point in the wire.

For the purpose of trying to determine the cause of wires breaking during the prevalence of sleet storms on the meadows in New Jersey, some time ago, I measured the strain of a number of wires with a wire dynamometer which was made for the occasion, and found that at a temperature of 65 degrees the strain in the iron wire was about 150 lbs. in each span, the length of which was 150 ft.; copper wire in the same span had a normal strain of from 200 to 250 lbs. The breaking strain of No. 8. B. & S. steel and iron wire when new is about 1,000 lbs., while that of copper is about 570 lbs. The majority of No. 8 wire tested had been in service about seven years, and we find the breaking strain now to average about 575 lbs.

The contraction that would have taken place in this wire with a drop in temperature of 65 degs. would have been nearly 0.7 in., which would have, according to further tests made, introduced an additional strain of about 175 lbs., making the total strain that would exist with the temperature at zero about 325 lbs., a little over one-half the actual breaking strain of the wire.

What kind of wire should we use? All wire deteriorates. Both iron and steel deteriorate very rapidly when exposed to gaseous vapors, while under similar conditions copper wire takes on a coating of some substance and does not appear to deteriorate as rapidly as the other named metals; but our experience with copper wire is as yet limited.

Some time ago I placed a section of copper wire in an unusually exposed place, where it constantly received the smoke from the engines passing to and from the roundhouse. After the wire had been up a year a small piece was taken out and the coating removed. The wire when first put up measured .085 of an inch in diameter; after the coating was removed it measured .081 of an inch, showing the wire to be actually .004 of an inch smaller than when first put up. From an electrical standpoint copper is not necessary as a conductor for the length of most railroad circuits. Copper wire does not possess the strength of either iron or steel wire. The ordinary telegraph circuit on railroad lines is worked with about .025 of an ampere of current. My observation leads me to believe that the simplex circuit can be worked reasonably well if the conductor consists of practically nothing more than a streak of rust. This, of course, is not admissible from a mechanical standpoint. Careful inspection has developed the fact that in many instances an order for iron wire has been filled with a certain grade of steel; this fact could only be determined by chemical analysis; therefore, in order to more nearly secure the grade of metal desired, we have found it desirable to require manufacturers to comply with the following specifications in furnishing either iron or steel wire:

1. Any sample taken at random must be so well galvanized that when plunged into a saturated solution of sulphate of copper and allowed to stand for two minutes, it will not, when taken out, show any copper-colored spots on the sides of the wire.

2. Any sample of wire taken at random must be capable of standing, without rupture, not less than 12 twists between vise jaws 6 in. apart.

3. The product of the weight per mile in pounds, into resistance per mile in ohms, must never exceed the number 5,200.

DISCUSSION.

MR. SELDEN thought that railroad people did not give the subject of line construction the attention it should have. If they were educated to understand that the telegraph was a necessity they would give more money for its maintenance.

MR. GEMMILL gave a description of the method of line construction on his road, the Atchison, Topeka & Santa Fe. Along the prairies the lines are built on the south side of the track, so as to avoid the danger of poles falling on the track during storms, the prevailing winds in that country being from north and west.

MR. LATTIG spoke of the advantages of steel insulator pins and copper wire, and of the length and life of poles.

MR. LOCKWOOD, in referring to the use of iron poles, stated that they were not safe nowadays, on account of leakage of electric light and electric railroad currents. Linemen were liable to receive severe shocks, which would cause them to fall off the poles. We can get along very well in this country without using pole preservative methods—as long as timber is plenty. No preservative process is of any value if only the butt is treated. If the entire pole were treated—from top to bottom—the life of the pole might be thus lengthened. He favored charring the butts of poles to a short distance above the wind and water line. He favored short poles. At bridges and in exposed places he thought that it was advantageous to break the symmetry of a line. It should there be built zig zag, and the poles set at different distances apart. The regularity should be broken in order to avoid the rhythm of vibration. The vibrations caused by the wind in one part of a line so built would be offset or counteracted by the vibration in other parts. Such a line will stand up under such circumstances when a symmetrically built line would fall.

The Lenox Avenue Conduit Road.

The Metropolitan Traction Co. has recently equipped the Lenox avenue Line, New York City, electrically. The public will shortly be able to travel from the Battery to 146th street, with one transfer, from the cable car to the electric car, at West 108th street.

The underground electric system employed differs from other systems of electric underground conduit railways, both in the construction of the conduit and the method of taking the current from the conductors. It has been operated experimentally for the past month, and its success has justified the sanguine predictions of the electricians and engineers who effected the installation.

The introduction of this system upon the surface lines of this city is the result of the determination of the Metropolitan Traction Company to give to New York a satisfactory electrical system of propulsion which would not make necessary overhead trolley wires. Consideration of the question resulted in the selection of a conduit system designed and manufactured by the General Electric Company, and Lenox avenue was chosen for the experiment.

In formulating the project, the Traction Company proceeded upon the most conservative lines, and determined to reduce the consequences of failure to a minimum. They, therefore, constructed the line as if for a cable road, in order that should the electrical system prove unsuccessful, it could be taken out, and the cables and pulleys of a regular cable system introduced, without loss of time and at comparatively small expense.

The Lenox avenue line is a double track road, starting at the car house at 146th street and running directly south to 116th street, into which it turns and proceeds as far west as Manhattan avenue. It turns here and runs as far south as 108th street, along which it is carried to the junction of that street and Columbus avenue. The district which this line will serve is at present somewhat sparsely settled, but the new line will probably cause a rapid development of a new residence section both on this and the other side of the Harlem.

The power house is a temporary frame structure with a sheathing of corrugated iron, located on 146th street, near Lenox avenue. The present plant consists of two 650 H. P. engines and two 400 K. W. generators.

Steam at 120 lbs. is supplied from a battery of two Babcock and Wilcox water tube boilers, rated at 250 H. P. each. The engines are of the cross-compound Allis Corliss type. All the steam piping is below the floor line. The 400 K. W. generators are wound for 350 volts instead of the usual 500 volts, in order to reduce losses from leakage.

From the generators the cables run beneath the switchboard through a subway to Lenox Avenue, where they enter 5-in. iron pipes running parallel with the conduit. For the present the line will be operated directly from the power house, but the feed wires will probably be placed in the pipes and tapped into the conductor at necessary points. This line will then be divided up into sections, and its general operation thereby greatly facilitated.

The construction of the underground contact system is simple. The plough suspended from the car truck passes through the slot in the center of the track and presses against the flat surfaces of two iron conductors running the entire length of the conduit, and placed each 3 in. on each side of the center of the slot to avoid snow, mud, drip, etc. These conductors are channel bars 4 in. deep and 30 ft. long. They are suspended from the ceiling of the conduit by means of insulators devised for the purpose, and are at a depth of 13 in. below the conduit slot (see Fig. 1). Each conductor is sufficiently rigid to require suspension at the ends and centers only, and the ends being located in the manholes and handholes being placed at the centers, renders inspection and repair comparatively easy. The conductors are bonded by stranded copper wire riveted into the web of the metal.

A modification of this system of suspension is introduced for a length of about 100 yds. of single track on 116th street, between Lenox and Seventh avenues. (see Fig. 2). At the manholes the conductors are supported by soapstone pillars. The channel bar conductors in this case are 5 in. deep and 12 in. below the slot. The soapstone pillars have iron caps, with brackets, to which the conductors are bolted. The bond is composed of flat copper strips riveted to the webs. The soapstone blocks are set in sulphur, in iron bases erected in the manholes.

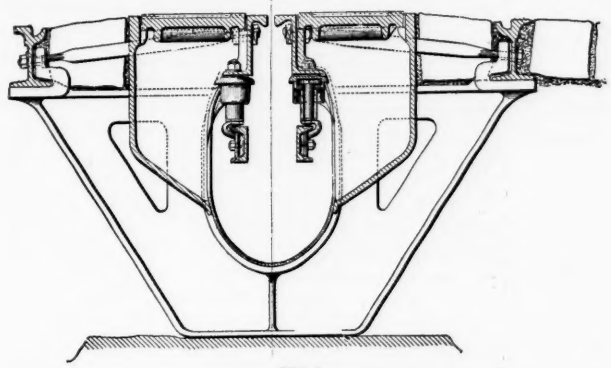


Fig. 1.

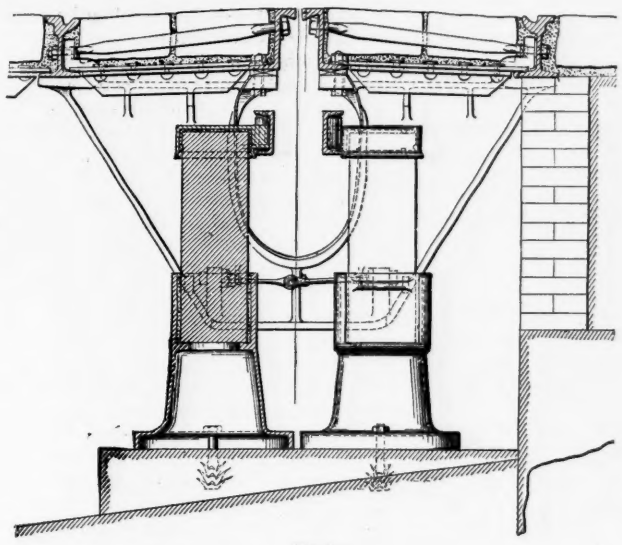


Fig. 2.

Fig. 3.

Sections of Conduit and Contact Maker, Lenox Avenue Line.

Every twelfth manhole is connected with the power house by telephone. Quick break switches are located in these manholes at intervals, in order that any section of the line may be cut-out in case of accident. At the track switches each conductor is provided with a flaring nose to facilitate the entrance of the plough between them. The manholes in which the insulators are placed are 4 ft. 4 in. deep, 4 ft. long, and 14 ft. 5½ in. wide, that is, the entire width of the two tracks. They are constructed of brick with 8-in. walls on concrete. The floors are 6-in concrete properly drained, so that no trouble from water in the conduit is anticipated. The pitch of the conduit will permit any water to readily find its way into the manholes, and thence into the sewers.

The return current instead of following the rails returns by one of the two conductors. Each conductor forms one side of the working circuit, the current being fed into the positive conductor and returning over the negative conductor. The current rises on one side of the plough, passes through the controllers into the motors and returns by the other side to the negative conductor.

The plough is essentially novel. The sliding contact consists of two pieces of iron, one on each side of the plough, supported on spring leaves, and thus pressed outwardly against the conductors. The plough is suspended from a longitudinal bar bolted to cross beams set upon the truck and is constructed of two sheets of steel laid each one upon a plate of fiber. The two sheets of fiber are then brought together enclosing strip copper conductors connected at the top to the motor cables, and at the bottom riveted to two other pieces of sheet steel. These run on each side of the plough and serve as supports for the hinges which carry the sliding contact pieces. A heavy sheet of fiber continues downward and serves to separate these contacts (see Fig. 3).

The motors employed are General Electric 800 machines.

The cars used were constructed by the John Stephenson Company and are mounted on standard cable trucks constructed by the Peckham Motor Truck and Wheel Co. The cars are lighted by 9 incandescent lamps in groups of three,

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
Published Every Friday
At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The Trunk Line Situation.

The Trunk Lines have agreed to restore eastbound freight rates which, as every one knows, have been badly cut for four or five weeks and very badly for two weeks. The restoration was decided on at a meeting in New York, June 27. We call it a Trunk Line meeting. The Central Traffic roads were represented in it and the organization and voting were in the usual joint-agreement fashion, but the occasion emphasizes the potent fact that the trunk lines proper (east of Buffalo, etc.,), control the roads through to Chicago, and it seems a waste of ink to use the clumsy double phrase in describing the whole body. The resolution says:

"*Resolved*, That from July 8, 1895, the Presidents or chief executive officers of the companies represented at this meeting pledge themselves to absolutely maintain the full published tariffs of eastbound and westbound freight rates on all classes of traffic, as now authorized by joint committee, until ten days after written notice is given the Commissioner of the Trunk Line or Central Traffic Association, by any member, of its withdrawal from the agreement; and, further, any contracts at rates below the authorized tariff shall be on or before July 1 filed with said Commissioners.

"This resolution to be continued in effect so long as it is observed by all lines hereto, and which question of observance shall be determined promptly by the Commissioners on complaint made. . . ."

After the meeting the presidents dined with Mr. J. Pierpont Morgan, and the gossips therefore call this another "gentlemen's agreement." This appellation, in its acquired meaning, probably fits the situation quite accurately. The original "gentlemen's agreement" in the winter of 1890-91, was essentially a word from the capitalists to the presidents of the roads west of Chicago that they *must*, at lest for a time, adhere to published tariffs. Each president must do this without regard to his wicked competitor's tricks. The stock and bond holders had decided that that was the *only* way to stave off receiverships. The stock and bond holders have now decided that rates *must* be kept stable in order to induce European capitalists to buy American securities—in order, indeed to prevent them from selling what they have—and they have said as much to the presidents.

Mr. Morgan's part in the matter is not definitely named in public, and, indeed, it is said that the influence referred to was so potent that the desired degree of harmony was fully accomplished at the meeting downtown—before the dinner; but it may be said that no better spokesman could have been found. Besides his direct interest as a railroad security holder, his contract with the government to keep gold from going out of the country impels him to the utmost exertions to sustain the general market. And, whatever the wording of the formal resolution, the weight of the action taken by the presidents depends entirely, as it has in all previous voluntary agreements of this kind, upon the spirit in which it was signed by the presidents of the rate-disturbing roads, and this is a factor which was susceptible of material modification six hours, or even six days, after the signatures were affixed. Let us hope that every harmonious impulse was strengthened.

An interview is published in which Mr. M. E. Ingalls, president of the Big Four and the Chesapeake & Ohio says:

"The agreement is a good thing. I am of the opinion that it will be carried out, and that rates will be restored on the 8th of next month. This agreement shows that the presidents can control matters when they have a mind to. The strong lines will get more than their share at first, but if the weak lines stand it for 60 days, it will show what differential rates they ought to have to give them a fair share. Sixteen men representing all the important lines, thrashed the matter out carefully for six hours, and arrived at an agreement which is much stronger than the money penalty which they (excepting Chesapeake & Ohio) voted for at a previous meeting and which was a clear violation of law."

(The Chesapeake & Ohio joined the Trunk Line Association.) As Mr. Ingalls is generally understood to have been the cause of the failure of the recent Chicago ageement, this utterance is an indication of the spirit of *one* president, which is quite significant. His allusion to a term of 60 days means, we understand, that the details by which Thursday's resolution shall be carried out is in the hands of a committee that may not get matters fully arranged in less than a month or two.

This interview contains two expressions which strike key notes, one of the way to get an agreement and one of how to use it. "The presidents can control" etc. We should say, rather, that the event shows that they *have the mind*. Every one knows that they *can* control. The trouble is that they do not wish to. Presidents have joined their traffic officers in the belief that they must cut rates to get business; this has caused all the trouble. True, we are still speaking of individual presidents, but so is Mr. Ingalls; it is no more true now than before, that the presidents as a body can do much; the body is not cohesive. All depends upon each president controlling his own subordinates, and he will control them if he wants to.

The other point is that the losers must live on faith for a month or two. A great many signatures have been affixed to traffic agreements by men who well knew that traffic cannot be evened up until after it has become uneven, but who, nevertheless, lost their courage as soon as they saw a little tonnage slipping through their fingers. Not only must the losers wait until they have actually lost freight before they can receive anything in compensation for it; they must, under present conditions, wait a considerable time beyond that, for the only practicable method of evening is by differential rates. Even with a money pool, such is the influence of old suspicions, it is hard enough to trust that justice will be forthcoming; to wait for the effect of a reduction of rates is still harder. One advantage of a president's agreement over one of traffic men is that the presidents are farther removed from the heat of strife, and so can possess their souls in patience a little longer—let us hope.

If we had made a preface to this article it would have been in the shape of an apology for seeming to give undue importance to an affair that, after all, affects only an extremely small percentage of the earnings of the railroads involved. The prevailing rate cutting is deplorable and in nearly every case foolish in the extreme; the sums wasted amount to many thousands of dollars, and we do not belittle the losses; but the influence that the losses will have on the real value of the stock or bonds of a railroad is grotesquely distorted in most of the statements published in Wall Street. The entire earnings on all the competitive freight out of Chicago and the gateways in its vicinity eastward probably does not amount to 2 per cent. of the total freight earnings of the roads interested. But it is the business of Wall Street to base big moves on insignificant circumstances, and Mr. Morgan, the presidents and all concerned must put up with the result. When "capital" shows timidity railroad men, like every one else, must inspire it with confidence in the best way possible. And so, although rate cutting, with shipments abnormally light, month after month, will not cause enormous losses, the railroads must mend their ways with the same care and patience that would be required if their whole income were at stake.

Electricity on the Railroads.

Two weeks ago we referred to a couple of articles of a semi-popular style which have recently appeared on the matter of the uses of electric motors on railroads. We should at that time have called attention as well to the excellent article by Mr. Joseph Wetzler in *Scribner's Magazine* for May. The writers of these various articles have treated the subject without pedantry, and their arguments are comprehensible at least, without which quality the wisest writing is of little use. A further contribution to this same general subject appears on another page of this issue, and it is an important one, being the inaugural address of the President of the Institute of Electrical Engineers, Dr. Louis Duncan, of Johns Hopkins University. We advise railroad officers and directors to read this address carefully, for it is very able and temperate. These are days when those who are responsible for the present and future prosperity of the railroads cannot sleep on both ears. It is their business to learn especially the possible uses and possible limits of electricity as "a mode of motion" on railroads, and to learn this as fast as they can. As Dr. Duncan says, the safety of the steam roads is to make of electricity an ally instead of an enemy, and this before it is too late.

A great deal of money has been wasted and a great deal more will be wasted in building electric rail roads. A great deal of harm has been done by these railroads to the steam railroads, and more will be done; and, unfortunately, their capacity for harm is not gaged by the profitableness or the usefulness of these electric railroads. It long ago became an axiom that the bankrupt road is the most dangerous competitor.

We have lately expressed the opinion that electric roads will occupy certain fields, namely, all city railroads, whether on the surface or above or below; also suburban service within some limited and indeterminate zone; also interurban service between cities and large towns not too far apart. Furthermore, it has seemed to us probable that electric railroads will do more of the local business between the small towns where it is permitted to lay such roads on the surface of the highways. Dr. Duncan foresees a still further spread of electricity into the domain of steam. He says: "In a few years electric roads will have absorbed practically all of the local traffic and will begin to cut into through transportation." His conclusions are that freight traffic in general cannot be economically handled by electricity; that the passenger service of a double-track main line railroad cannot be done by electricity; that on a four-track road it would be worth while to equip all the tracks for electricity, doing part of the service with that motive power and part with locomotives, if we understand his position; that branch lines in the regions of less dense traffic, as well as the suburban lines near the cities will all be operated by electricity. Some of this we accept as probable, indeed, as highly probable; some of it we doubt, but we shall not stop to discuss that part of his argument now.

Dr. Duncan does not differ from others who have looked somewhat carefully into this matter as to the fundamental principle that for economy in electric operation the units moved must be small and frequent. He appears, however, to be inclined to believe that these conditions can be found or created on existing steam railroads oftener than most of us are willing to admit. But whether or not he is over sanguine as to the future of electricity, and whether or not we are over conservative, there can be no doubt that a very important, not to say dangerous, element has been introduced into the already complicated "railroad problem," and it is the business of the intelligent railroad man to inform himself, and that speedily, as to the bearings and limitations of this element.

How great the existing danger is does not seem to be appreciated by railroad men generally; on the other hand how great is the cost and difficulty of the change does not seem to be appreciated by electrical engineers, and especially by electric promoters. A great local traffic may be, and doubless will be, diverted to electric lines; but this diversion will bring also radical changes in the methods of building and equipping electric railroads, in track and in machinery, in methods of protecting the public by separation of this electric railroad traffic from the highway traffic, also by the separation of grades of electric rail roads and steam railroads, and in methods of acquiring right of way and other franchises. In all of these particulars there will be a radical and costly change; a fact which is already pretty well appreciated so far as track and equipment go, but apparently not so far as legal and social rights and obligations are concerned.

But supposing the local passenger traffic is very largely taken away from the railroads, of how much importance is this? Can the railroads afford to lose it? We know a president of one great system, entering one of the largest cities of the country, who says that he would be glad to get rid of all suburban business. It is costly, troublesome and done at very low rates. We question if this is the general judgment of railroad men. We doubt, indeed, if the president in question would willingly surrender his suburban traffic. But at any rate the profits from this kind of traffic are small and in many cases dubious.

In 1893 the passenger earnings of all the railroads of the United States were about 25 per cent. of the total gross earnings. The earnings from passengers, mail and express were 29½ per cent. of the gross earnings. The earnings from freight were 68½ per cent.

These are the figures of the Interstate Commerce Commission's statistician. Of course the percentages vary greatly in different regions. For instance, in the Commission's group I. (the New England States) the passenger earnings were 48 per cent. of the total and and the freight earnings 51, and in group X. (the Pacific Coast states) the passenger earnings were 35 per cent. and the freight 63. But according to the same authority only about 7 per cent. of the passenger earnings are profit. We express no opinion as to the accuracy of this guess, but probably it is near enough for present purposes. That is, out of the whole sum of the gross earnings of railroads 1.8 per cent. was profit due to the whole passenger business. It would seem as if this entire business might be surrendered and no great harm done, but in fact this meager profit from the passenger business was about one-fourth of the whole sum available for dividends.

The Interstate Commerce Commission gives no data as to through and local passenger business. After all, such averages are more curious than useful. The question for each road will be: How much passenger traffic can we afford to lose; how much are we likely to lose; how much could we save and how much could we gain by offering more facilities, such as could be given by small and frequent electric trains? In settling these questions each railroad will have to make a special study of its own special case.

We find, for instance, on the New York, New Haven & Hartford the passenger earnings are 58 per cent. of the total gross. How much of this is local and could be drawn off by electric suburban and interurban lines we are not told; but it would be an important part of the revenue of the road. On the Lake Shore the local passenger earnings are 84 per cent. of the total passenger earnings and over 18 per cent. of the total gross. On the Michican Central the local passenger earnings are over 22 per cent. of the gross earnings of the road and 80 per cent. of all the passenger earnings. It is apparent that in these cases a very important part of the revenue of the roads is subject to the incursions of the trolley.

What is to be done? That question is too hard a one to be answered at the tail end of an article already too long.

The decision of the New York State Court of Appeals, that a policeman employed by a railroad and paid by it a salary, might rightfully use an annual pass over the road, given to him as a part of his compensation, was noted in the *Railroad Gazette* of June 7, page 369. The case was that of William J. Dempsey, employed by the New York Central, whose pass was withdrawn on Jan. 1, 1895, when the new state constitution went into effect. Through the courtesy of Mr. Frank Loomis, General Counsel of the New York Central, we have received a full copy of the decision. It refers to the fact that Dempsey was appointed under chapter 565 of the railroad law, which authorizes the appointment of railroad policemen and specially provides that the compensation of such policemen shall be paid by the railroad company. The court holds that Dempsey is undoubtedly a public officer, but that his relations with the road under the contract distinguish his case from that of an ordinary public officer. It is "the obvious intention of the constitution to prohibit public officers from receiving privileges, favors or gifts that might improperly influence them in the discharge of their official duties." Therefore, if this provision applies to the plaintiff it is due to the fact that he is accepting a *free* pass, a gift from the defendant. This court, however, held, more than 30 years ago, in the case of a man riding on a freight train in charge of cattle, that the holder of a pass who had compensated the corporation therefor could not be regarded in any just sense as a gratuitous passenger. Dempsey's pass was in no sense a free pass within the the meaning of the constitution, but on the contrary was a pass for which the plaintiff had paid a full consideration. Continuing, the decision says: "We have not overlooked the argument advanced by the learned counsel for the appellant that such a construction will render it easy to evade this provision of the constitution by contracts between corporations and public officers for private services by the latter, which shall be paid for in transportation. We do not think any such danger exists, as each case must be decided upon its own facts, and the courts will see to it that the provisions of the constition are properly enforced. The distinguishing feature in this case is that that the plaintiff is a public officer whose only duty to the public is limited and defined by his contract with the defendant."

One of the most important railroads remaining to be built in the world will connect the eastern end of the Mediterranean with the railroad system of India. Many suggestions as to the route of this great line have been made. It was Sir Edward Watkin, we believe, who proposed to cross the channel by a tunnel, then go down through France and Spain, have a car ferry across the Straits of Gibraltar, thence by rail along the north coast of Africa and so through the north of Arabia into the valley of the Euphrates; thence down the eastern shore of the Persian Gulf and through Beluchistan. Probably the first part of this line to be built will be from the eastern end of the Mediterranean, leaving the portion in the north of Africa for a later generation. Indeed, we question if the Asiatic link is imminent, for the great waterway answers all requirements so well that the railroad could not pay commercially; its great value must be strategic. Nevertheless, there are a good many Englishmen who feel that England must promote such a railroad in order to counteract the influence of Russia in Asia if for no other reason. Within a few weeks a Mr. Black, writing in the *Con'emporary Review*, has advocated a route beginning at Port Said and ending at Karachi, just beyond the eastern frontier of Beluchistan. This line would be about 2,400 miles long and would make the time from London to Karachi about seven days. This line will run easterly to the Euphrates, then down the eastern side of the Persian Gulf and skirt the southern edge of Beluchistan. The latter country is now under British control and Southern Persia is at least as much under British influence as under that of any other power. It is recommended that the line should be as close as possible to the Persian coast in order that it might be defended by landing troops. A branch could be carried to Jeddah and Mecca which would do a large business at some parts of the year in carrying pilgrims. The engineering difficulties of the line are passed over very lightly and presumably they would not be great.

The Austrian state railroads had an unusually prosperous season in 1894. The system included 5,238 miles of railroad, which is a little more than one-half of the total in Austria. The state system is of comparatively recent creation. Only 140 miles were added to it in 1894, but some important lines will be acquired before long if the present policy of the Government is carried out. In 1894 the gross earnings of the state railroads were 9.3 per cent. greater than in 1893 and the net earnings 15.7 per cent. greater. The profits were at the rate of 2.77 per cent. on the capital invested, against 2.52 per cent. in 1893. The state system consists partly of roads built by companies with a state guarantee of interest, which were a great burden on the state before it acquired them. Reckoning the interest which the state has to pay on the part of its railroads which it built itself, at 4¼ per cent., its loss on its railroad system last year was about $10,000,000, a portion of which, however, is for a sinking fund, which in time will extinguish the interest-bearing securities. No less than 93.2 per cent. of the passengers traveled third class, which is a very strong indication that the provision of accommodation for three classes is unprofitable. Nearly three-fifths of the passengers traveled less than 12½ miles; that is, were included in the first two zones of the present Austrian tariff. Only 3.1 per cent. of the number traveled more than 125 miles. The average receipt per passenger was about 25.4 cents, and the average per passenger mile 0.997 cent. All baggage was paid for under this tariff, and the average rate received for it last year was 11.38 cents per ton per mile, which would be at the rate of about $8 for a 150-lb. trunk between New York and Chicago. The total earnings from baggage amounted to less than $600,000, and not quite 6 per cent. of the receipts for passage. Receipts from express freight were about double this amount. The rates on this traffic averaged 7.21 cents per ton per mile, which would be about 86 cents for 100 lbs. from New York to Boston or Washington, and $3.46 to Chicago. The average rate on ordinary freight was 1.40 cent per ton per mile, which seems here very high compared with a passenger rate of less than 1 cent per mile. It is, however, the lowest average freight rate which these roads have received, and nearly 6 per cent. lower than in 1893, the increase in traffic having been chiefly in grain and other coarse freights which are carried at the lowest rates. There were 24,804 regularly appointed employees on the state railroads, not including 5,010 workmen in its 13 shops. The regular employees are classified as 5,749 "officers" (Beamten), 3,711 sub-officers, 9,227 servants, and 6,117 watchmen (chiefly road guards). The average wages of the men in the shops were 90 cents per day.

The humble corn-cob is the main factor in the latest railroad "device" that we have heard of. The corn-cob should be kept in mind in fixing the height of overhead bridges, for such structures should always be made far enough above the track to permit a tall brakeman to stand "straight as a cob" on top of a car in passing under the bridge. It is also important to stipulate that the cobs shall be left in, when contracting with a shipper to take corn fuel in payment of freight charges on his corn sent to market, for the ears can be burned on grates where shelled corn would be very bothersome. Beyond this we had no idea that a cob was worth a copper to a railroad company. But in the corn states of the West it appeals more effectively to the thoughtful economist, and the scheme to which we refer is one for kindling fires in locomotives, used on the Chicago, Milwaukee & St. Paul, at Marion, Ia. It was adopted after trying various other plans, and an officer of the road describes it as follows: We take a pail holding 12 quarts of dry corn cobs and pour over them one gallon of fuel oil. About 6 in. of coal is spread on the grate, and the corn cobs are thrown as evenly as possible over the surface of the coal. They are ignited by throwing in a piece of lighted paper or oily waste. They catch fire at once and the fire spreads rapidly over the entire surface of the box. As thus arranged we can get 50 lbs. of steam in a cold engine in an hour and a half without difficulty. This is as quick as it is safe to start a fire in a cold engine. If it were safe and desirable to start the fire more quickly, it could be done by increasing the quantity of cobs and oil. The quantity of cobs and oil can be reduced where there is time to start the fire more slowly. The cost of the oil is about two cents a gallon and the cost of the cobs for one fire about a quarter of a cent, so that the kindling of a fire will not exceed two and a quarter cents. No air blast is used in connection with this method. The advantages of this plan are several. No air blast is needed, engines running on branches can carry a pail of saturated cobs from a division point, or a few cobs and a barrel of oil can be provided where the engine is kept over night, so that the watchman can build the fire. We have tried several absorbents, but have found nothing that will freely absorb oil except corn cobs. These in themselves contain a large amount of carbon. It is not necessary to soak dry cobs more than five minutes before casting them into the firebox.

One evening last week Mr. J. P. Morgan gave a dinner to a large party of presidents of Trunk Lines and of railroads in the Central Traffic Association. His first plan was to have the dinner on his yacht Corsair, but at the last moment this plan was abandoned, and the dinner actually took place at the Metropolitan Club in New York. There has been a good deal of speculation as to the objects which Mr. Morgan had in mind in giving this dinner and in giving it on board his yacht. "We are in a position to say" just what the facts were. It was Mr. Morgan's purpose to get these gentlemen aboard, and then take them for a three months' cruise on the high seas. At the last moment he was persuaded not to try the effect on the "railroad problem" of this entirely novel expedient, for a reason which is not likely to exist long, and therefore we are not without hope that a similar plan may be carried out soon. Considering the activity of the Spanish cruisers it was feared that these distinguished gentlemen might be landed in Moro Castle as a party of filibusters. Naturally, this would have been an international incident, even more acute than firing on the Alliança for the trivial offense of landing one or two revolutionary leaders. The newspaper war which would have ensued would have been even more bloody than that famous campaign. No doubt Mr. Morgan was sagacious in giving up this plan, but for some reasons we regret it extremely. It will be hard to catch so many presidents again. They are quite too wary to be easily trapped now that their suspicions are aroused.

We commend to the attention of those persons (if there be any such) who set out to read "everything in the railroad line" to a bibliography at the end of a recently published German work on "Transportation," which forms one volume of an economic encyclopædia now in course of publication. This bibliography covers 57 royal octavo pages, and the editor, Kuno Frankenstein, warns us that it omits all purely technical publications and such as are devoted to separate branches of transportation, and the yearly reports of railroad companies; while, on account of the size of the volume, only recent foreign periodicals could be considered. If the other pages have as many titles as the one we counted this bibliography has about 1,700 titles.

We had hoped that the month of June would not pass without the appearance of the customary monthly electric elevated railroad between New York and Chicago. We have not been disappointed. On the 30th, articles of incorporation were filed in Springfield, Ill., for the Transcontinental Company, with a capital stock of $200,000,000, It is the intention to build an elevated railroad "between New York and Chicago in the first place, and afterwards to San Francisco and elsewhere." The speed of trains is to be not less that 100 miles an hour. One of the incorporators informs the reporters that "it has been demonstrated that electric railroads are cheaper than steam."

NEW PUBLICATIONS.

Cassier's Magazine for July is a thick volume in a cover of special design, and is called a "Niagara Power Number." Within its handsome cover of white, blue and gold we find a wealth of half-tone illustrations, which in number and excellence surpass any we have yet seen in scientific magazine work. With the assistance of these illustrations the subject of water power development at Niagara Falls is looked at from many different points of view.

Among the names of authors contributing papers we find those of Coleman Sellers, W. Cawthorne Unwin, John Bogart, Clemens Herschel and others almost as well known. The question of Niagara's development for commercial and manufacturing purposes is treated from the standpoint of the civil, electrical and hydraulic engineer, the capitalist, and even historically, in conjunction with a number of old engravings. Along with this is a chapter on European Water Power Installations, by Col. Turrettini. The number is one of which its editors may well be proud.

Outing Trips and Tours is the title of a pamphlet issued by E. W. Bullinger, 75 Fulton street, New York City, as a supplement to No. 26 of his *Monitor Guide*, well-known to all railroad men in the Eastern States. The supplement is unique. The editor evidently has become tired of the dull routine of making a guide for

freight shippers and he has made an excursion into the excursion field; and his success is no less remarkable than in the work which has made his reputation. This outing book, containing about 100 large pages of reading matter and pictures, and enough advertisements to pay for it, has the prominent characteristics of the *Monitor;* it bears the marks on every page of the most painstaking accuracy; every paragraph shows that it was written with full knowledge by a traveler of experience, and the occasional mention of reasons why one should *not* patronize a certain line or take some course often followed, even by passengers who are not "green," evidences the frankness which gives the reader confidence in the ability and disposition of the writer to do full justice to his subject *and to the reader.* The book deals mostly with summer excursion routes in the Eastern States, Lower Canada and others within 200 miles of New York City, special prominence being given to trips which can be made from New York for a few dollars. The numerous half-tone illustrations from photographs are nearly all new and the text is all original.

TECHNICAL.

Manufacturing and Business.

R. W. Hildreth & Co., 50 Broadway, New York, have the contract for the mill and shop inspection of the new bridge at Norwalk, Conn., for the New York, New Haven & Hartford road. That firm is also inspecting the material and manufacture of the structural steel and iron for the new Wellington Hotel, Forty-second street and Madison avenue, New York City.

Joseph H. Cofrode has filed two petitions at Philadelphia, asking that he be discharged as receiver of the Reading Rolling Mills Company and also of Cofrode & Saylor, incorporated.

The Phœnix Iron & Bridge Co. advanced the wages of 2,000 employees of the company on July 1. The works are now running full time on some large orders, including the material for the Sioux City bridge, on which work has been resumed. The works are running night and day.

Iron and Steel.

The Tennessee Coal, Iron & Railroad Co. has announced an advance of $1 a ton on iron. This makes the present price of No. 1 foundry iron at the furnaces $9.75, which is an advance since April 1 of $2.75 a ton. The price of gray forge iron goes correspondingly to $8.75 a ton.

The Sloss Iron & Steel Co. has followed the Tennessee Coal & Iron Company in announcing an increase of five cents a ton in the wages of its 3,000 miners.

An advance in miners' wages of 5 cents a ton to 42½ cents is made with this advance in price of pig iron, under the terms of the sliding scale.

The contract for furnishing rails for 35 miles of the Mobile & Birmingham road, which was recently bought in by the bondholders, has been awarded to a Mobile firm, the Southern Log Cart & Supply Co.

The iron manufacturers of the Pittsburgh district and the Amalgamated Association officials will meet this week, and will probably decide on a scale similar to the one recently agreed upon between the iron manufacturers of the Manoning and Shenango Valleys. The scale adopted at Youngstown begins with a $4 rate a ton for puddling, on a card of 1⅛ cents a pound for bar iron. The puddler will receive an advance of 25 cents a ton for each advance of $\frac{1}{10}$ of a cent a pound in bar iron.

The Wellman Iron & Steel Co., which failed over 18 months ago, has been reorganized, and the plant at Chester, Pa., will probably be started up in a few weeks with a large number of orders on hand. The officers elected are as follows: President, William Burnham; Vice-President and Treasurer, J. Tatnall Lea; Secretary, D G. Stokes. The directors are: William Burnham, J. Tatnall Lea, William G. Neilson, S. T. Wellman, J. S. Patterson, David R. Williams and J. H. McCullough. The new company will be known as the Wellman Steel Co., and will have a capital stock of $1,000,000. The offices of the corporation will be at Thurlow.

The Cleveland Steel Co. has made an advance of 10 per cent over the present tonnage rates on the plate mill and plate.

The Bar Iron Manufacturers' Association at Youngstown, O., last week, decided to advance the price of bar iron $2 a ton. The advance goes into effect at once, and is the second of the same amount in a short time.

The Oliver Iron & Steel Co. has advanced the wages of its puddlers from $4 to $4.25 a ton. This is an advance of 25 cents over the scale adopted by the Amalgamated Association several weeks ago. The Oliver mill is operated by non-union employees.

At the annual meeting of the stockholders of the Bethlehem Iron Co., at Bethlehem, Pa., on June 25, 88,424 shares were represented. The following directors were elected: Robert H. Sayre, Sr., E. P. Wilbur, Robert P. Linderman, George H. Myers, Joseph Wharton, Beauveau Borie and J. Bertram Lippincott. The board elected: Robert P. Linderman, President; R. H. Sayre, Sr., and R. W. Davenport, Vice-Presidents; C. O. Brunner, Treasurer; A. S. Schroop, Secretary; Owen F. Leibert, Superintendent, and R. H. Sayre, Jr., Assistant Superintendent.

The Carnegie Steel Co. has let the contract to Martsolf Bros. & Co., of New Brighton, Pa., for the erection of wo large new additions to the Beaver Falls nail mill. One of the new additions will be 85 ft. long, while the other will be an extension to the present buildings, part of which were destroyed by fire last February. When the additions are completed the capacity of the plant will be more than doubled.

New Stations and Shops.

The new passenger station of the Western Maryland Railroad at Walbrook, just beyond the city limits of Baltimore, was completed and put in use last week. This station was built for the special convenience of residents in the northwestern part of Baltimore. It is quite a handsome structure and was described in the *Railroad Gazette* some weeks ago.

A corporation is being organized by a number of business men of Fort Worth, Tex., with the object of building a new Union station at that city. The project is said to have the endorsement of the officers of the principal lines entering Fort Worth, and another meeting of the organizers to complete the organization of the corporation is to be held at Fort Worth on July 6, when it is expected that the railroad officers of nearly all the lines entering Fort Worth will be present. J. W. McLean is President, and B. B. Paddock, Mayor of Fort Worth, is Secretary of the provisional company.

A. & P. Roberts & Co.'s Pencoyd Iron Works are running at their full capacity, and the 2,000 employees are making full time. In order to increase the facilities for handling the large bridge girders and other heavy work, the firm has been obliged to reconstruct part of the works. Among the contracts now being filled are the Pennsylvania Railroad's Delaware River bridge, and the great Blackwell's Island bridge for the Long Island Railroad, N. Y.

The New York, New Haven & Hartford is to build a new passenger station at Ashmont, Mass., from plans made by Mr. Bradford L. Gilbert, of New York City. The building is 21 ft. × 66 ft. and is made of slate colored Weymouth granite, natural face, trimed with Scotch granite. The building stands on ground several feet higher than the track platform and the steps leading to the latter, opposite the center of the building, have an ornamental roof. The building is finished inside with quartered oak. In the main waiting room 10 of the windows are plate glass and 10 clouded glass. The upper halves of all the doors are filled with small panes of whirred glass. The building is to be heated by hot water. The contractors are Messrs. Whidden & Co., of Boston.

The Canada Atlantic Railway Co. have offered to build workshops at Ottawa East, Ont., if exempted from taxation.

The Illinois Central will at once erect a passenger station at Bloomington, Ill. The building will be of brick and stone, and will cost $25,000.

The handsome office building erected at Portsmouth, Va., for the use of the general officers of the Seaboard Air Line, was completed last week and the transfer of the offices of General Manager John H. Winder, and all the other general officers of the company still remaining at Atlanta, Ga., will be removed to Portsmouth by July 15.

The Illinois Central will build a new six-stall brick roundhouse at Sioux City, south of Eleventh street. The present roundhouse near Eighth street will be demolished.

A new station is to be built at Mankato, Minn., by the Chicago & Northwestern and the Chicago, St. Paul, Minneapolis & Omaha, and a large part of the officers of this company, including the general managers of both roads, visited Mankato last week in connection with the plans for this station and the other changes in the terminals, the plans including the re-location of some of the tracks near the river front which will involve an important expenditure.

The Virginia Railroad has decided to build a new freight house on the site of the old building now used for that purpose in Lynchburg, Va.

Progress of Track Elevation Near Jamaica Plains.

Work is going on upon the line of the New York, New Haven & Hartford near Forest Hills station in elevating the tracks of that road after the plan described in the *Railroad Gazette* for June 14, 1895. The first point of attack was on the main line about three-quarters of a mile beyond Forest Hill station. Between this point and the station the tracks have been spread 5 ft., which was done to facilitate the work of elevation. The easterly track has already been partially raised along this section of the road, the bed having been gradually raised until it is now about 9 ft. above its former level at the curve near Forest Hills, from which point it again returns on a gradual slope to grade at the station. This track will be raised about 18 in. more The track next to this is also being raised, having already reached a point about 4 ft. above its former level. The work is being done gradually in the intervals between trains in order that traffic may not be interrupted.

Work is also going on at the West Roxbury Branch between Forest Hills and South street. Here the work in progress consists in widening the road for about 23 ft. to admit of spreading the tracks before raising them. Near Jamaica Plains station a number of buildings on the east side of the road are being torn down or moved back from the line of the tracks about 30 ft. This is for the purpose of allowing room for auxiliary tracks which will be put in to accommodate traffic during the progress of the work, as well as to make room for the slope of the fill.

Between Jamaica Plains and Boylston stations the buildings on the east side of the road are being removed and the work is being continued upon the culvert for Stony Brook as described in the previous article upon the subject. From Center street inward nothing yet has been done. The work in this vicinity will include the removal of many buildings.

The Electric Motor for the Baltimore Belt Line.

On the night of June 26 the generators in the power house of the Baltimore Belt Line Branch of the Baltimore & Ohio were started and the current allowed to pass through the overhead circuit throughout the tunnel. This test of the connections was satisfactory, and on the following day the electric locomotive No. 1 was run through the tunnel, hauling a steam locomotive. Two successful trips through the tunnel were made during the day. A speed of 20 miles an hour was attained, using a portion of the full current. Officers of the General Electric Co., of the railroad, the Maryland Steel Co., who erected the overhead structure for the line, and of the E. P. Allis Co., who furnished the engines for the power house, were present at the trials.

Opening of the North Sea and Baltic Canal.

The keystone of the canal was set by Emperor William on June 21, at Holtenau. After this ceremony a naval review took place followed by a grand banquet, at which over a thousand guests were present.

The Holyoke Dam.

The contractors for the construction of the new dam across the Connecticut River at Holyoke, Mass., which was described in the *Railroad Gazette* of March 8, will soon begin work upon the structure. A cableway is being erected from one shore to the other directly over the site of the dam, for conveying material from the shore. The towers for these cables, which were made by the Trenton Iron Works, are now being erected. The cable is a steel wire rope, about 2 in. in diameter and weighing 10 lbs. per foot, and is 2,110 ft. long. The contractors for the dam are the Fruin-Bambrick Construction Co., and Henry S. Hopkins, both of St. Louis. The dam is to be about 1,000 ft. long and 30 ft. high.

A New White Star Liner Launched.

The new White Star Line steamer Georgic was launched from the ship yards of Harland & Wolff, at Belfast, on June 22. She will have a gross register of over 10,000 tons and has accommodations for 900 head of cattle.

Egypt (N. C.) Coal.

The Seaboard Air Line has made a contract with the Egypt Coal Company, of Egypt, N. C., for 100 tons of coal a day. The road has made a thorough test of this coal on its locomotives, as it was claimed that it contained too much sulphur to be advantageously used in locomotives. The tests proved that the claim was incorrect.

The Handhold and Ladder Law.

The Secretary of the M. C. B. Association sends out the following circular: As nearly as can be learned, by correspondence and conference with representatives of the Interstate Commerce Commission, the Federal Law in regard to handholds or grabirons on the sides of cars [see *Railroad Gazette*, June 7, p. 367] will be complied with if cars have such handholds or grabirons on the sides adjacent to steps or ladders for getting upon the cars, and that no further use of handholds or grabirons on the sides of cars is contemplated; in fact, it is admitted that any further use of such handholds or grabirons on the sides of cars would be objectionable. Where ladders are on sides of cars the rungs of such ladders will furnish sufficient handholds. As to the requirements of the law providing handholds or grabirons on the ends of cars, it is conceded that where there is a ladder on the end of a car, the lower rung or step of such ladder constitutes a handhold or grabiron; as required by the law, for one side of the end of the car, and that where an uncoupling rod for M. C. B. coupler is so located as to be easily grasped by the hand such rod constitutes a handhold or grabiron, as required by the law, for at least one side of the end of the car. It is further conceded that the recommended practice of the association, as shown on M. C. B. Sheet A, of September, 1893, illustrating the application of handholds to box cars, complies with the requirements of the law about handholds or grabirons for this class of car, and also that handholds located vertically on the corner posts of the car, either on the ends or sides of the cars, are a fulfillment of the requirements of the law in such locations for such cars. In regard to flat cars, any least objectionable location on the end sills of such cars of any suitable grabirons or handholds, which a man may grasp in case of need while engaged in coupling or uncoupling cars, is said to be a fulfillment of the requirements of the law.

The Lake Street Elevated, Chicago.

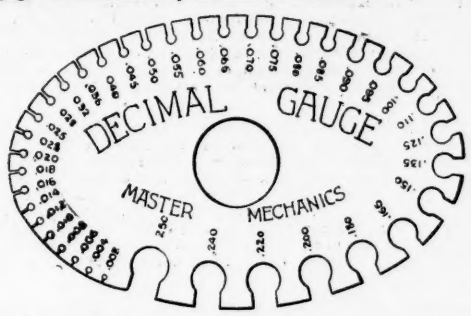
The extension of the Lake Street Elevated east on Lake street to Wabash avenue, which was mentioned in the *Railroad Gazette* of March 1, 1895, has been practically finished. The superstructure has been completed, with the exception of building the stations and laying the track. Wabash avenue will be the terminus until something definite has been done regarding the downtown loop. Stations will be built at State street, Clark street, and Fifth avenue. It is expected that trains will be operated on this extension within thirty days.

The contract has now been let to equip the the Lake Steet Elevated with electrical motive power, and the General Electric Company will furnish the equipment. The third rail system will be used, similar to that on the Metropolitan Elevated. The power will be furnished by

the Western avenue power station of the West Chicago Street Railway Co. The contract calls for 35 motor cars which will be supplied from the cars now in use by putting on new trucks, similar in construction to those on the Metropolitan. Two G. E. 2,000 motors will be used on each motor car, one of which will be on each truck.

Gages for Sheet Metal Tubes and Wire.

The accompanying engraving shows the solid elliptical gage recommended by the Master Mechanics' Committee



on Gages and referred to in our report of that committee last week. The cut was omitted at that time.

A New Steamship for the Cromwell Line.

A steel passenger and freight steamship, 325 ft. long, 44 ft. wide and 33 ft. deep, is to be built for the Cromwell line, at Newport News. The vessel will run between New York and New Orleans. She has accommodations for 150 steerage passengers and 74 cabin passengers. Her engines are 3,500 H. P., giving her a speed of 15 knots. With the large vessel now being built for the Plant Line, and three gunboats for the government, the Newport News Shipbuilding & Drydock Company has plenty of work on hand.

An Accident at Homestead.

A serious accident has caused the closing down of a part of the Homestead Steel Works, owned by the Carnegie Steel Company. The wristpin of a large rolling-mill engine broke, resulting in a general wrecking of the cylinders and valve gear. Two weeks will be needed in which to make the necessary repairs, during which time 500 men will be idle. This delay will be particularly felt, since the works were running at their utmost capacity, being overrun with orders.

THE SCRAP HEAP.

Notes.

The average speed made on the recent 1,000 mile relay bicycle race, Chicago to New York, was 15⅛ miles an hour.

It is reported that Mrs. Frank Holmes, widow of the locomotive engineer on the Chicago & Alton, who was murdered by train robbers at Carlinville, Ill., a few weeks ago, has received a gift of $2,500 from the railroad company.

Another general advance in the price of foundry pig iron was announced July 1 by the Thomas Iron Company. No. 1 X advanced to $13.50; No 2 X for foundry, $12.50; No. 2 plain to $11.75, and gray forge to $11.50 per ton. The above prices are at the furnace. The advance averages $1 a ton.

The Chicago, Burlington & Quincy has sued Cook County and the city of Chicago for damages sustained at the time of the strike riots in 1894. The bill against the county is $100,000, and that against the city $50,000. The Illinois Central Railroad has filed a similar suit for $100,000 in the Circuit Court against the City of Chicago. Damages are claimed for injuries to cars and delays to business.

The Delaware, Lackawanna & Western has come to an agreement with the Buffalo Grade Crossing Commissioners as to appointing a special commission to settle the "crossing problem" in that city so far as it affects that road. The Erie still delays final action. It makes strenuous objection to the clause in the contract between the city and the New York Central, which allows the latter road to close Alabama street.

The preparations for mail cars on the cable railroads of New York City seem to progress rather slowly. It was announced last week that Second Assistant Postmaster-General Neilson had completed arrangements with the Third Avenue line, the mail cars to be attached behind cars carrying passengers. Negotiations with the Broadway line are still unfinished. The New York Mail & Newspaper Transportation Co. has made a proposition to the trustees of the New York & Brooklyn Bridge to lay a pneumatic tube on the bridge to connect the New York and Brooklyn post offices, and it is said that the offer will be accepted. It is intended to have two tubes about 8 in. in diameter. It is said that the post office authorities favor the project.

The full bench of the Supreme judicial court of Massachusetts has decided, in the case of Stephen A. Brownell and others vs. The Old Colony Railroad Company, that the road must operate the ferry over the Acushnet River between Fairhaven and New Bedford, but that it is not to be liable to a forfeiture of $100 a day as provided by the statute of 1894. The proprietors of the New Bedford & Fairhaven ferry transferred under the statute of 1854 to the Fairhaven Branch Railroad Company all the rights and powers conferred on the ferry company by its charter, with a provision that the railroad company should be held to perform all the duties prescribed thereby, and that after the transfer the ferry should become a part of the railroad. The Old Colony is the successor of the Fairhaven Branch. The court further says that the commonwealth did not waive its rights by allowing the ferry to remain inoperative 20 years.

Rain Making.

A press dispatch says that Mr. Frank Melbourne, a rainmaker, has admitted that the whole thing is a humbug, and that he never had any more power than any other man to bring rain. He says that in America, "the greater the fake, the easier it is to work it." We sympathize deeply with Uncle Jerry Rusk, who persuaded Congress to appropriate several thousand dollars for rain-making experiments; also with brother St. John, or whoever is responsible for spending the money of the Chicago, Rock Island & Pacific in these alleged experiments. But our sympathy is mitigated by the fact that they ought to have known better.

The Atlanta Exhibition.

The Central of Georgia, the Georgia Railroad and the Atlanta & West Point will join in the erection of a handsome building for a display of the resources of their respective territories at the Cotton States and International Exposition.

The Sloss Iron & Steel Co., the Tennessee Coal, Iron & Railroad Co., and the Pioneer Mining & Mfg. Co., have each signified their intention of making exhibits at the Atlanta Cotton States and International Exposition. These companies represent the most of the coal and iron industry of the South, and will be able to make an attractive showing.

M. C. B. Rules.

The Rules of Interchange, as revised at Alexandria Bay in June, and which are to go into effect on Sept. 1, 1895, will be ready for distribution about July 20, and they will be furnished at the same rates as heretofore, viz.: 25 copies, $1; 50 copies, $1.75; 100 copies, $3. A less number than 20 copies at five cents per copy. Postage will be added in all cases when sent by mail. There will be no printing on the cover except "Revised 1895," unless otherwise ordered and specified, in which the case the additional printing on the cover will be charged additional at cost. Parties who wish copies of these revised rules should make requisition for the same to the office of the Secretary and specify additional printing on the cover, if wanted.

Anticipating an Injunction.

The Big Four has completed its terminals at Louisville, and is now ready to run its trains to that city over the new Louisville & Jeffersonville bridge. The bridge was finished some days ago and the terminals were nearly complete. The Louisville Trust Co. on Saturday last applied for an injunction to prevent the laying of the final track in Washington street. The injunction was to be argued Monday, but on Sunday a gang of 250 men were put at work and laid the last terminal track. A train made up of two flat cars, four box cars and two passenger coaches was run across the bridge just before midnight Saturday. On the train were Assistant General Manager Schaff, Chief Engineer Kittredge, and several other officers of the road. Work on the terminals was finished Sunday and it is announced that trains will be running regularly in a few days.

New Lake Superior Docks.

The Tamarack and Osceola Mining Companies have definitely announced their intention of building new coal and merchandise docks at Dollar Bay, in the Northern Michigan Peninsula. The improvements will cost $60,000. The new dock will entail a longer rail haul to the mines, but will save charges of 10 to 50 cents a ton now made by the Calumet & Hecla Company through the Torch Lake Canal on all cargoes going to Lake Linden.

Philadelphia Electric Railroads.

The Directors of the Electric Traction Company, of Philadelphia, have decided to increase the capitalization to the full amount authorized, $8,750,000, by the issue of 22,604 additional shares, of the value of $50 each, to which the stockholders will be entitled to subscribe in the ratio of one share and a small fraction of a share for each seven shares of present holdings.

Bridge Failures.

A recent press dispatch from Owensborough, Ky., states that a 30-ft. steel bridge gave way under a traction engine and threshing machine near that place, killing two men. It is said that the cause of the failure was the absence of two bolts. It was a new bridge.

At Grand Rapids, Mich., June 15, the sidewalk of a railroad bridge gave way, precipitating into the river about 25 persons who were watching pile drivers at work near by. Seven of the persons were injured.

Lake Notes.

The biggest craft so far built on the lakes was launched on Saturday last, at Chicago, the "Victory," and three weeks later the "Zenith City" is to be launched for parties at Duluth and Cleveland. The vessels, which have been briefly described in this journal, and are 405 ft. long, will go at once into the ore trade between Duluth and Lake Erie. But they are not destined to keep their distinction long. Last week a contract was signed between the Globe Iron Works Co., of Cleveland, and the Menominee Transit Co., for the immediate construction of a steel vessel about 420 ft. long. The boat will carry not less than 7,000 tons on the 20-ft. draft, and 4,000 tons on 14.5-ft. It is expected to have her in commission this fall, and she will carry ore from Escanaba to Lake Erie.

Steel ship construction is looking up, and the indications are that many of the largest class of vessels will be built for use the coming season. Contracts were let last week to the F. W. Wheeler Company, at Bay City, for two vessels of the largest size. Syndicates and private parties on the lakes at Cleveland, Detroit, Chicago and Duluth are now figuring on no less than seven vessels of the largest size and most modern construction. The cost of these vessels will be somewhat more than last year, probably 10 per cent, on account of the advance in steel and labor.

It is reported that the new Canadian canal at St. Mary's Falls, though opened officially a few weeks ago, is not ready and may not be for a month or two to come. There is a dispute between the government and the contractors, and the officials who are to have direct charge have not arrived. The lock pits must be deepened and the channel is not buoyed. American vesselmen are not a little disappointed, as they had hoped to send their ships through and avoid delay and use the deeper draft this summer.

In about a month the steel gates at the new American canal at the "Soo" will be completed. They are the first of their kind and the largest in existence. They are five double leaved gates, and they weigh 1,350 tons. Three are about 46 ft. high, each half gate or leaf is 55 ft. wide and all are built truss fashion, to withstand the great pressure of the water The present stage of water at the American canal ranges about 14 ft., and the new stage will be 20 ft. Vessels can then load to 19 ft., or perhaps more. This is a difference of 60 in. in carrying capacity, and means an addition of 1,600 to 1,800 tons dead weight to any one of the new style craft as soon as the new canal is ready.

The Duluth & Winnipeg ore docks at the head of Lake Superior, which were built three years ago under a contract between that road had the Duluth, Missabe & Northern, and which have been idle since the latter road put in its own docks a year later, received their first cargo of ore this week. The Mahoning Ore Co. will probably ship over the road about 250,000 tons this year.

More business was done by the Duluth & Iron Range road one week in June than in any corresponding time in its history. It had 70 vessels booked for its ore docks, and loaded 59, carrying 120,000 tons.

Two new mines began this week to ship ore over the Duluth, Missabe & Northern road to its Duluth docks. These are the Ohio and the Sellers. The former will ship about 1,000 tons daily, the latter nearly as much.

Brooklyn Heights Railroad.

The Directors of the Brooklyn Heights Railroad Company have elected Clinton Rossiter President and Henry Seibert a Director, to succeed E. W. Bliss, resigned, and Col. Timothy S. Williams to succeed William Marshall, deceased. The resignation of W. A. H. Bogardus, as Secretary and Treasurer, was accepted, to take effect July 1, and Col. T. S. Williams, private secretary of ex-Gov. Flower, was chosen Secretary and Treasurer, to succeed Mr. Bogardus.

Rapid Transit in Baltimore.

The Edmondson Avenue, Catonsville & Ellicott City Electric Railway Co., which constitutes a portion of the Baltimore & Washington Boulevard electric line, has secured control of the Catonsville Short Line Railroad, a branch of the Baltimore & Potomac, about 3.8 miles long. This road has hitherto been operated by steam. It is proposed to connect the Catonsville terminus of the steam road with the electric road on Edmondson avenue, the entire system to be operated by electricity hereafter. Work on the Edmondson avenue line has progressed to a point about four miles beyond the city limits. A portion of the connecting line will of necessity be laid with flat rails instead of T rails, to avoid obstructing travel on a narrow lane through which it will run. The roads are standard gage throughout. The cars to be used will seat 100 persons, and will be lighted by electricity. In addition to these lines, an electric line is to be built to Catonsville on the Frederick road, and the suburbs, Mt. Winans, Westport, Lansdowne and Meters Park, are to be connected with the city by electric lines.

The Northwestern Docks at Superior.

A second section of the Northwestern Coal Railway Co.'s dock, at the head of Lake Superior, will be built this season. This section is 3,000 ft. by 450 ft., and with the one of the same size built last year will make one-third the complete dock. Ultimately this dock will be by far the largest coal receiving dock in the world.

Equipment for Japanese Railroads.

K. Minami, a representative of several Japanese railroads, is now in the United States for the purpose of making some extensive purchases. He has given to the Baldwin Locomotive Works an order to build six locomotives for shipment to Japan. This contract, when completed, will make 50 engines in all built by this firm for the railroads of Japan. Mr. Minami was the first person to give an order for American railroad equipment for Japan, he having purchased the first locomotive.

South American Notes.

The Société Générale, and the Crédit Industriel, at Paris, are offering 50,000 five per cent. bonds of 500 francs each, of the São Paulo & Rio Grande Railroad Co., of Brazil, the proceeds of the issue to be used in an extension of this line south and west into the Rio de la Plata countries, constituting a north and south trunk line, practically a continuation of the Companhia Geral. The line is to be of metre gage, and will be 1,192 miles in length when completed.

The great need of a grand trunk line in Brazil to connect the numerous isolated port-feeding railroads, which has so often been pointed out by the *Railroad Gazette*, seems at last to have impressed the Brazilians. A project is now being seriously considered for the construction of such a line, connecting eleven states, and developing the valleys of the São Francisco and the Araguayá. The line is to be called the East-Western Railroad of Brazil, and the government is to be asked to guarantee six per cedit on a capital of $30,000,000. This may very likely be done in view of the proposed transfer of the Brazilian capitol to the State of Goyaz in the watershed of the Araguaya. We believe that the Clark Brothers, well-known in connection with the Transandine Railroad, are concerned in this new enterprise.

The São Paulo Railroad, Brazil, has finally submitted to a new arrangement, whereby it surrenders its exclusive privilege to enter the port of Santos. This will bring it into open competition with the Sorocabana and Mogyana railroads, which are progressive lines, owned and operated by Brazilians.

One outcome of the recent Mining and Metallurgical Exhibition in Santiago, Chili, has been to purchase by the Chilian government of the large concentration and metallurgical plant sent out by the Krupps. This is to be maintained as a state sampling and testing works under the administration of the Sociedad Nacional de Minería. Chilians may here have practical mill tests made of their ores upon payment of costs, without additional fees. It is probable that this plant will form the basis for an extension of the Manual Training School of Santiago into a school of mines and engineering.

LOCOMOTIVE BUILDING.

The Pennsylvania is reported to have given orders for building 18 new locomotives at the company's shops at Altoona, Pa. Seven of these engine will be class R freight locomotives, and four will be shifting engines, class U. The type of the other engines included in the order is not given.

CAR BUILDING.

The Kansas City, Pittsburgh & Gulf is in the market for 100 box cars.

The Queen & Crescent Co. has placed an order with the Ohio Falls Car Co. for 200 box cars to replace vacant numbers.

The Wisconsin & Michigan Railroad Co. is in the market for 500 box cars, 34 ft. long, of 60,000 lbs. capacity, to be used in connection with the Lake Michigan Car Ferry Transportation Co., between South Chicago and Peshtigo Harbor, Wis.

The directors of the San Francisco & San Joaquin Valley Railroad, a company which proposes to build over 300 miles of railroad through the San Joaquin Valley, last week let the contracts for building 150 cars for that line. The order was given to John Hammond & Co., of San Francisco, and includes 100 platform cars and 50 box cars. The delivery of the first lot of 10 platform cars is to be made at Stockton by Aug. 1. It is stated that the directors had under consideration three bids from California firms and one from an Eastern builder. The cars are to be built of Oregon pine and California redwood, and the builders agree to use California material in all parts of the car where it is possible.

BRIDGE BUILDING.

Brampton, Ont.—The County Council of Peel and York are about to let the contract for a bridge across the Etobicoke River, between the two counties, situated at the base line, near Craig's.

Enoree, S. C.—The Port Royal & Western Carolina Railway is replacing the existing wooden trestle at Enoree with a 700 ft. viaduct. This bridge will be designed by R. W. Hildreth & Co., of 50 Broadway, New York City, and that firm has also been engaged as engineers to inspect the material for the structure during manufacture.

Lachenaie, Que.—Sealed tenders, addressed to the Mayor of the Municipality of Lachenaie, will be received for the construction of the piers and the steel structure for a bridge in Lachenaie, at the mouth of the St. Jean Baptiste, according to plans deposited at the office of O. Villeneuve.

Marshall, N. C.—The Southern Railway Company will build a stone causeway, to cost over $25,000, at Marshall, Madison County, N. C., on the Western North Carolina Railroad division, to take the place of the present wooden trestle.

New York City.—The new East River Bridge Commission, which is to supervise the building of the bridge to connect Grand street, New York, with Broadway, in the Eastern District of Brooklyn, which is to be built by the two cities, met last week for organization. The following officers were chosen: A. D. Baird, President; S. H. Wales, Vice-President; F. B. Thurber, Secretary; Richard Deeves, Treasurer; John C. Bouton, an accountant, was appointed Assistant Secretary.

Ottawa, Ont.—The plans of the proposed bridge across the Ottawa River, connecting Grenville and Hawkesbury, have been on view at the office of the Great Northern Railway in Ottawa. Two plans have been prepared, one for a wooden and the other for an iron bridge. The combined length of the approaches to the latter is about 1,500 ft., and the bridge itself 1,677 ft.

Pittsburgh, Pa.—The Beaver Road & Newville Island Bridge Co. has recently been organized and filed its charter at Harrisburg last week with a capital stock of $5,000.

Victoria, Tex.—The County Commissioners have awarded the contract for the iron bridge across the Coletto at $3,475, and for the one across the Garcitas for $1,599; the Penn Bridge Co., of Pittsburgh, secured both contracts.

Wheeling, W. Va.—The Wheeling Bridge & Terminal Company has begun extensive improvements at Martin's Ferry, O. A trestle, about 1,500 ft. in length, ranging from 20 ft. to 50 ft. high, is being rebuilt in a new location to obviate several sharp curves. When this trestle is completed, it will be immediately filled in with earth throughout the entire length.

Wilkes-Barre, Pa.—The new bridge connecting Wilkes-Barre and Plymouth was opened June 27. The bridge is for foot passengers and electric cars. The bridge cost $150,000 and was built by the Pennsylvania Bridge Co., of Beaver.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Canada Southern, 1¼ per cent., payable Aug. 1.
Central Pacific, ½ per cent., payable July 1.
Columbus & Cincinnati Midland, 1½ per cent. on the preferred stock, payable July 1.
Delaware, Lackawanna & Western, 1¾ per cent. upon the capital stock, payable July 20.
Detroit, Hillsdale & Southwestern, 2 per cent., payable July 5.
Granite Railway Co., $2 per share, payable July 1.
Lake Shore & Michigan Southern, semi-annual, 3 per cent. upon the capital stock, payable Aug. 1.
Michigan Central, 2 per cent. on the capital stock, payable Aug. 1.
New York Central & Hudson River, quarterly, 1 per cent., payable July 15.
Northern of New Hampshire, quarterly, 1½ per cent., payable July 1.
Northern of New Jersey, 2¼ per cent., payable July 15.
Petersburg, 3 per cent. on the common and preferred stock, payable July 1.
Richmond & Petersburg, 3½ per cent., payable July 1.
Western Alabama, 2 per cent., payable June 20.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Hancock & Calumet, annual, Hancock, Mich., July 9.
Marquette, Houghton & Ontonagon, annual, 301 Nester Block, Marquette, Mich., July 18.
Mineral Range, annual, Hancock, Mich., July 9.
Negaunee & Palmer, annual, 301 Nester Block, Marquette, Mich., July 18.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Western Railway Club* meets in Chicago on the third Tuesday of each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *New England Railroad Club* meets at Westevan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the second Friday of January, March, May, September and November, at 2 p. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street New York, on the first and third Wednesdays in each month, at 8 p. m.

Association of Engineers of Virginia.

The Association of Engineers of Virginia met in its fifth annual session at Washington and Lee University, Lexington, Va., President J. C. Rawn, of Roanoke, in the chair. The session lasted two days.

Yard Masters' Association.

A convention of Yard Masters was held at Denver June 27, and the National Yard Masters' Association was formed. Mr. J. M. Glunt, of Staples, Minn., was chosen President; Joseph McMahon, of Chicago, Vice-President, and J. W. Coneys, of Cincinnati, Secretary and Treasurer. There is no insurance department in the organization.

The Western Foundrymen's Association.

We have received from the Secretary of the Western Foundrymen's Association the following letter, which we print with pleasure as a way of giving a little aid to a useful institution. The President of the Association is Mr. J. M. Sweeney, and the Secretary Mr. S. T. Johnston, the office being 1522 Monadnock Block, Chicago.

"At the annual meeting of the Western Foundrymen's Association, it was unanimously decided that its best interests would be advanced by incorporating the Association under the laws of the State of Illinois. This will at once be done, and will relieve the members from any possible liability in the conduct of the affairs of the Association.

"The Association is now in its third year, and as its formation was closely followed by the panic of 1893, the members feel highly encouraged over the success which it has had, and believe the Association must have a brilliant future. The purpose of the Association need only be understood to insure a greatly enlarged membership and an increased interest in its affairs.

"The objects of the Association are not in any way connected with questions of trade, either prices, product or of wages paid; they are purely and clearly technical, and it is the purpose to make the meetings a medium for the interchange of ideas, of practical experience in founding, so securing from each other knowledge of methods of procedure in certain cases, the consideration of the application of chemistry to foundry business, new methods of molding and the handling of finished, unfinished or raw products.

"The cost of membership is extremely low; the initiation fee is $5, and the annual dues $10. The literature which is sent out by the Association, and which becomes the property of the members, is alone worth much more than this amount. A membership taken out by one concern entitles any of its members to attend the meetings of the Association, and to join in its deliberations and the discussion of its papers.

"It is particularly desired that members of the Association shall endeavor to have their managers, superintendents or foremen attend the meetings of the Association, and join in the discussions. It is the interchange of ideas that the Association wishes to procure and put into its records. The Association wishes every one to feel entirely at liberty to discuss questions at its meetings, or to contribute papers on matters from individual experience.

"It is the purpose of the Association, if possible, to hold some of its meetings at other points than Chicago, and as the membership grows, this policy will be followed up with the idea of holding them at various other places, which will enable the members to visit establishments of note and interest to the foundrymen outside of Chicago."

PERSONAL.

—Mr. J. H. Stewart, of Sandusky, O., was last week appointed Receiver of the Columbus, Sandusky & Hocking Railroad in Ohio.

—Mr. W. E. Griggs, General Manager of the Jamestown & Lake Erie road since its organization, has resigned that office and has removed to Cleveland.

—Mr. T. M. Orr, who for a number of years has filled the position of General Freight Agent for the Atchison, Topeka & Santa Fe, at Pittsburgh, has been transferred to a similar position in Chicago.

—Mr. James K. Geddes, General Manager of the Bellaire, Zanesville & Cincinnati Railroad, operating a line between Bellaire and Zanesville, O., was last week appointed Receiver of the company.

—Mr. T. D. Devant, of Memphis, has been offered the position of Commissioner of the recently organized Bureau of Freight and Transportation at Memphis. Mr. Devant was until recently Assistant General Freight Agent of the Memphis & Charleston Railroad.

—Mr. W. B. Sterling, for the past five years attorney of the Chicago & Northwestern, at Huron, S. D., has been appointed general attorney for the Fremont, Elkhorn & Missouri Valley road, with headquarters in Omaha, taking the place made vacant by the death of General Hawley.

—Mr. Harvey M. Littell, formerly President and General Manager of the New Orleans City and Lake and Crescent City Railroad, of New Orleans, was last week elected President and General Manager of the Atlantic Avenue Railroad Company, one of the lines of the Brooklyn Traction Company, in place of Mr. Benjamin Norton, resigned.

—Mr. C. E. McPherson, Passenger Agent of the Canadian Pacific Railroad, located at St. Johns, N. B., has been transferred to Toronto, Ont., as District Passenger Agent to succeed Mr. W. R. Calloway. The latter has recently been made General Passenger Agent of the Minneapolis, St. Paul & Sault Ste. Marie, which is one of the controlled lines of the Canadian Pacific.

—Mr. William B. Thomas, of Atlanta, who has been General Manager of the Atlanta & Florida Railroad for the past few years, will remain in charge of the operation of that line when it is turned over to the control of the Southern Railroad which recently purchased the property, being appointed Division Superintendent of the Southern Railway in charge of this division.

—Mr. Mathias R. Moran, formerly General Ticket Agent on the New London Northern Railroad, now operated by the Central Vermont, died at New London, Conn., where he was a Deputy Collector of Customs, last week. Mr. Moran, after leaving the New London Northern, was with the Jacksonville, Tampa & Key West Railroad, but recently he had been in the United States Custom House service at New London.

—Mr. Clinton L. Rossiter was last week formally elected a Director and President of the Brooklyn Heights Railroad in Brooklyn, N. Y., and entered upon his duties on July 1. As stated last week, Mr. Rossiter has been Assistant Superintendent of the Western Division of the New York Central & Hudson River road, and in his new position will have the management of an extensive electric street railroad which is being practically reconstructed by the men who have recently secured control of the property.

—Mr. Grant Wilkins, the well-known Bridge Engineer of Atlanta, has resigned his office as Chief Constructor of the Cotton States and International Exhibition which is to be held at Atlanta, Ga., during the fall. Mr. Wilkins was appointed to this office soon after the plan for an exhibition was put under way, and he has had in direct charge the most important part of the building work on the grounds at Atlanta, having supervised the erection of all the main structures which are now practically completed.

—Mr. George L. Bradbury, General Manager of the Lake Erie & Western Railroad, has taken charge of the operation of the Pittsburgh, Akron & Western road, the control of which was recently secured by Mr. Calvin S. Brice, the President of the Lake Erie and Western. It is understood that this appointment of Mr. Bradbury is temporary, pending the appointment of a General Manager for the property. Mr. Robert Blee, of Toledo, is mentioned for this office. He was formerly General Superintendent of the old Bee Line. Since he left railroad service he has served a term as Mayor of the city of Toledo.

—Prof. Thomas Henry Huxley died at Eastbourne, England, on the afternoon of June 29. He was not an engineer, nor was he a railroad man; but thousands of engineers and railroad men who love sound thinking and clear expression will be grieved to hear of his death. We know of no man of his generation who equaled him in simplicity and directness of thought and word. His great intellectual powers and his thoroughly just and manly instincts were reinforced and made available for the use and instruction of mankind by a wonderful gift for good writing. There is little literature so well worth assiduous reading by young men as Huxley's essays, and their greatest value perhaps is that they teach, from beginning to end, the lessons of honesty and courage.

—Mr. W. W. Gwathmey, Jr., has been appointed Chief Engineer of all the railroads comprising the Seaboard Air Line, with headquarters at Portsmouth, Va., where the general offices are now located, except the office of the President, which remains at Baltimore. The office of Superintendent of Roadway has been abolished, and the lines operated by the Seaboard Air Line have been divided into three divisions, with division superintendents, with headquarters respectively at Portsmouth, Va.; Raleigh, N. C.; and Atlanta, Ga. The divisions are composed as follows: First division, T. W. Whisnant, Superintendent, Portsmouth, Va.; Seaboard Railroad, between Portsmouth, Va., and Weldon, N. C., and Raleigh & Gaston, between Weldon and Raleigh, N. C., distance 268 miles; second division, William Moncure, Superintendent, Raleigh, N. C.; Raleigh & Augusta Air Line, Raleigh to Hamlet, N. C.; Carolina Central, Wilmington to Monroe, N. C.: Pittsboro branch and Hamlet and Gibson branch, a distance of 385 miles. The third division will include the Carolina Central from Monroe to Charlotte, N. C., and all the road from Charlotte to Atlanta, 272 miles; V. E. McBee, Superintendent, Atlanta, Ga., who will also hereafter have charge of the company's freight and passenger interests.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—William Bradley, formerly passenger engineer on the Pittsburgh division, has been promoted to road foreman of engines on the same division, to succeed James Emery, resigned.

Georgia Southern & Florida.—Six new Directors of the railroad were elected at a meeting held in Baltimore June 27. The changes in the Board were the result of the control acquired by the Southern Railway Co., and were made at the suggestion of President Spencer of the Southern. The new Directors are President Spencer, and Second Vice-President A. B. Andrews, of the Southern; George W. Parrott, of Atlanta, Ga.; Major J. F. Hanson, T. D. Tinsley, and Morris Happ, of Macon, Ga. The directors who retire from the Board are Messrs. Henry Rice and D. W. Herman, of New York; C. D. Baldwin, A. B. Hull, Edward McIntyre, and Col. William Rogers, of Savannah, Ga.

RAILROAD CONSTRUCTION

Astoria & Columbia River.—A committee of citizens of Astoria, Or., which some time ago undertook to secure the right of way for this line along the Columbia River east of Astoria, as requested by J. B. Hammond, of Missoula, Mont., who has agreed to construct the line if the right of way is secured, has been successful in getting all the property needed except in a few instances. Mr. Hammond, after spending some time in New York in the interest of this railroad, has just returned to Astoria and announces himself as ready to begin the work east of that town as soon as the Astoria committee completes the work it has agreed to do. The line is to extend from Astoria along the south bank of the Columbia River to a connection with the Northern Pacific at Goble, Ore. The distance is about 63 miles, and for some part of the distance out of Astoria, is already graded, this work having been done a few years ago by a company which soon became bankrupt. W. G. Joslyn is General Manager of the new line. Mr. Hammond is President of the Oregon Central & Eastern Railroad, which is a reorganization of the old Oregon Pacific, that line having been purchased by Mr. Hammond at the foreclosure sale some time ago.

Canadian Roads.—Another railroad in the Ottawa Valley is projected to extend from Renfrew, Ont., north to Thorne Centre, in Pontiac County, via Portage Su Fort, at which place the Ottawa River will be bridged. The road will be about 50 miles in length. From Renfrew to Portage Su Fort, a distance of about 15 miles, it will pass through the townships of Horton and Ross, which are among the finest farming districts in the whole Ottawa Valley. The chief promoter of the new line is Mr. A. A. Wright, of Renfrew. It is understood that J. R. Booth, of Ottawa, is also interested.

Chateaugay & Northern.—J. P. Mullarkey, of Montreal, Secretary of the company, announces that proposals will be received for the construction of the road from Montreal to Bout de l'Isle, in the parish of Pointeaux-Trembles, a distance of about 12 miles. The company's office is at 1608 Notre Dame street, Montreal.

Chesapeake & Western.—E. Purcell, Jr., & Co., who were awarded the contract for building the first section of this line beyond Harrisonburgh, in Rockingham County, Va., some months ago, have now completed the grading to Dayton, the first station west of Harrisonburgh. The construction work is now being carried on by this firm east of Harrisonburgh, where a connection is made with the Valley Branch of the Baltimore & Ohio, to Elkton on the Norfolk & Western, the distance being 18 miles. The contract for building the line through Rockingham County west of Harrisonburgh into West Virginia, crossing the Shenandoah Mountains, has been awarded to the firm of Van Aken & Hays, of Washington, D. C., who will establish their construction headquarters at Harrisonburgh, Va., and the Ferguson Contracting Co. The next point west of Dayton to be reached by the new line will be Bridgewater, and this will complete the first 27 miles of the new line. This much of the new line, it is expected, will be completed during the summer. The road crosses the famous valley of Virginia and opens up an important agricultural district, besides reaching valuable timber and coal districts on the mountain section of the line. A recent report has it that J. W. Reinhart, recently President of the Atchison, Topeka & Santa Fe Railroad, is now financially interested in this new railroad and will take charge of the development of the company's plans. The Dominion Construction Co., of which E. C. Machen, of 1 Broadway, New York City, is President, is the construction company building the line.

Chester, Farmington & Western.—A. J. Cooper, President of this company, which was incorporated in Missouri early this year to build a line west from the Mississippi River at a point opposite Chester, Ill., reports that work has now begun on the Eastern Division of the line and that the company has funds to complete a considerable portion of the proposed line. The line now under construction is from St. Genevieve, nearly opposite Chester, to Farmington, Ill., and thence a few miles further on to a connection with the St. Louis, Iron Mountain & Southern. The road will open up a valuable timber country within easy distance of the markets.

Choctaw Coal & Railway.—Capt. J. W. Hinckley, who is Chief Engineer of the new connecting line now being built between the eastern and western divisions of this railroad, reports that the tracklaying is being pushed very rapidly, and he expects to have through trains running over the division before Sept. 1 next. Up to July 1 about 30 miles of track had been laid on the division 15 miles east of Oklahoma City and 15 miles on the other end of the new line west from the present terminus of the western division at South McAlester, toward Oklahoma. This leaves about 90 miles of the railroad on which the tracklaying is still to be done. George S. Good & Co., of Lock Haven, Pa., are the contractors for the contracting work on this division.

Cleveland, Canton & Southern.—Plans are being perfected for extending the Cleveland, Canton & Southern Railroad from Bowerston, O., to Wheeling, W. Va. John W. Wardwell, General Superintendent, holds judgments against the right of way and surveys of the old South Pennsylvania & Ohio Railroad, for $148,000. He is also Receiver of the Cleveland & Wheeling Road, the franchises and rights of way of which are part of the South Pennsylvania & Ohio road, which will be sold under the judgment held by Mr. Wardwell in August. The franchises and surveys reach from Bowerston to Wheeling, following for a part of the way the general route of the Wheeling & Lake Erie. At Martin's Ferry, the route connects with the Wheeling Bridge & Terminal road.

Columbus, Huntington & Guyandotte.—At a special election held in the counties of Cabell and Wyoming, W. Va., last week, it was voted to issue $100,000 of bonds in each county, to aid in the building of the above named road. Elections are to be held in Boone, Lincoln and Logan counties this month to decide the question of issuing $50,000 each for the same purpose. The road is to begin at the Ohio River in Cabell County, near Huntington, and follow Guyandotte River from the mouth to its source in Logan County. It is about the same line which it was reported the Chesapeake & Ohio contemplated building about a year ago.

Denver, Lakewood & Golden.—President Samuel Newhouse, of Denver, states that the extension beyond Golden, West to Idaho Springs, Colo., will probably be undertaken this year. He has recently gone over the route for this extension with representatives and a London and Amsterdam syndicate which has become interested in the property and he expects to be authorized to begin the extension of this line as soon as the representatives return to Europe. This extension will reach an important mining country at Idaho Springs, and it is stated that concentrating mills will be erected at that point when the new line is built.

Escanaba, Frankfort & Southeastern.—Articles of incorporation of this company were filed in Michigan last week, C. W. McCall, of Boston, being President of the company; W. A. Smith, of Grand Rapids, Mich., Vice-President; and A. C. Hale, of New York City, Treasurer. The company has been organized to operate the Frankfort & Southeastern road, which has been until recently operated as a division of the Toledo, Ann Arbor & North Michigan. The line is about 25 miles long, running from Copemish, on the Ann Arbor road, to Frankfort, on Lake Michigan, and was built to give the Ann Arbor road an outlet to Lake Michigan.

Hinton, New River & Western.—The actual work of construction on this line has been commenced at Hinton, W. Va., and will be continued along New River. At present about 200 men are employed, but this force will be doubled in a few days. The surveyors are at work at several points along the line. Summers County has voted to give $50,000 to the road. A description of the line was published May 31. J. T. McCreery is President.

Galveston, La Porte & Houston.—It was expected to open the through line of this company between Houston and Galveston, Tex., for traffic this week. The work remaining to be completed is a short section beyond Clear Creek on the line between La Porte and North Galveston. Clear Creek is crossed at this point by a drawbridge. The distance between Houston and Virginia Point on the main land, opposite Galveston, is 50 miles, which is about the same length as the Gulf, Colorado & Santa Fe line between the two towns. It is expected to have trains on the new road running into the city of Galveston during the fall. To accomplish this it will be necessary to construct a long bridge between Virginia Point and Galveston Island, but this work is now under contract, and the erection of the structure from Virginia Point has been commenced.

Gulf & Interstate.—An arrangement has been made by President E. De Normandie, of Galveston, by which the construction of the line from Point Bolivar, opposite Galveston, through to Beaumont, Tex., is assured. President De Normandie and the General Manager, Fox Winnie, are now in St. Louis to arrange for the purchase of the construction material, and will probably go on to Pittsburgh. The interests of C. J. & N. C. Jones, who were the contractors on the short portion of the railroad now built on Bolivar Peninsula, have been purchased by Galveston interests. About 6½ miles of the line on the Peninsula, from Point Bolivar, which is just opposite Galveston, has been completed. This leaves 63 miles to construct to reach the town of Beaumont on the Sabine River. The ties and timber for bridges will be supplied by the lumber mills at Beaumont, whose owners have agreed to accept the first mortgage bonds of the railroad company in payment. The company has not so far made arrangements for terminals at Galveston. The cost of building the docks and wharves and transfer boats between Point Bolivar and Galveston will be heavy, and the company has asked the citizens of Galveston to subscribe for $250,000 of its six per cent. first mortgage bonds to provide funds for completing these Galveston terminals.

Hendersonville & Brevard.—The laborers engaged in the building of this road in Western North Carolina quit work in a body last week and work had not been resumed when our correspondent sent these particulars. The men say that they have not received any wages for over five weeks.

Kansas City, Pittsburgh & Gulf.—It now seems likely that a branch of this line will be built into Fort Smith, Ark. The present survey for the line south of Sulphur Springs carries the line east of Fort Smith, the company claiming that on account of unfavorable grades it would be very expensive to build the main line through Fort Smith. When the company asked for terminal grounds and aid for a branch from the main line into Fort Smith, which would be about 16 miles long, the citizens of the town declined to accept the proposition or to grant any facilities except for the main line. The company refusing to change the location of its line, the people have receded from their position, and have now agreed to secure the right of way and the ground within the city limits asked by the company for its station ground. It is expected that the new line into Fort Smith will be in operation within six months.

Newfoundland.—It is reported that over 2,000 men are now working on the extension of the Government railroad toward Hall's Bay. William G. Reid, of Montreal, has the contract for building the entire line as projected by the Newfoundland Government and he states that probably 100 miles will be built this year. Next year it is hoped that the line will be finished to Port Basque, which is the proposed terminus of the line, a point 200 miles beyond St. Johns, Newfoundland. This road will be operated by the Government, being taken over from the contractors as soon as completed. It has figured to some extent in the recent complications in Newfoundland.

New Orleans & Western.—The Delta Construction Co. of New Orleans has been recently organized to build this road, as stated last week. Contracts have just been let for a portion of the work. The new railroad is to be a belt line 20 miles around the city of New Orleans, beginning at Avondale, in Jefferson Parish, running through the swamps back of New Orleans and connecting with all railroads, and ending at the Battle Ground Plantation, 1½ miles below New Orleans, in the parish of St. Bernard. The Battle Ground Plantation is four miles square, with a river front of one mile, and is owned by this company, and will be used as the general terminal for New Orleans. A large grain elevator is now under contract, also the two largest compressors in this country. Plans are being made for warehouses to hold 250,000 bales of cotton, together with one mile front of wharf, with separate places for fruit, lumber, cotton and cotton seed oil products. Mr. A. W. Swanitz is the Consulting and Chief Engineer. Mr. J. L. Nisbet, of 40 Wall street, New York, is the President.

New Roads.—Austin Corbin, of New York City, President of the Long Island Railroad, is understood to be the chief projector of a new line in Southern Arkansas from Sunnyside, a small town in Chicot County on the Mississippi River, south of Arkansas City directly west to Hamburg, in Ashley County, crossing the St. Louis, Iron Mountain & Southern about half way between these towns. The distance is about 40 miles and the road runs through a well-settled country with large cotton plantations, but which at present is without any railroad facilities except what is given by the St. Louis, Iron Mountain & Southern, which runs north and south through the eastern part of Ashley County.

Pennsylvania.—Important improvements are being made at various points on the Toledo Division, and new rails and sidings are being built, and for the first six miles of railroad out of Toledo to Walbridge new rails are being put down, the section weighing 70 lbs. to the yard.

Pittsburgh, Virginia & Charleston.—The Girard Life Insurance, Annuity & Trust Company of Philadelphia, has entered for record at Uniontown, Pa., a mortgage against this property for $6,000,000. The bonds are in two issues, one of $4,000,000 and the other of $2,000,000. Part of the loan was used to satisfy a mortgage of $3,000,000 held by John P. Green and Strickland Kneass, trustees. What the company is going to do with the remainder of the money is not positively stated. Hon. J. K. Ewig, a director in the Pennsylvania Company, which holds more than half the stock of the road, when interviewed, refused to say positively what was to be done, but intimated that the road is to be extended this year into West Virginia, along the Monongahela River. The Pennsylvania Company has had in mind the building of such a line for several years, and the control of the Pittsburgh, Virginia & Charleston was secured with that end in view. Some time since the Baltimore & Ohio built a line from Uniontown, Pa., to Morgantown, W. Va., and at the time this work was begun the Pennsylvania's representatives secured the right of way for a road along the opposite bank of the Monongahela River. This right of way is still held.

Rochester & Southern.—About 500 men are now working on this branch road, the line being an extension of the Rochester & Honeoye Valley road, operated by the Lehigh Valley from its present terminus at Honeoye Falls, south of Rochester, N. Y. The new road will be built nearly directly south to the northern end of Hemlock Lake. The length of the new line is 14 miles and the construction work is now about two-thirds completed. The grading is very easy, the maximum grade on the line being 52.8 ft. to the mile and the maximum curvature five degrees. The new road crosses the tracks of the Tonawanda branch of the New York Central road and the Honeoye Falls & Lima Railway at Honeoye Falls by an iron plate girder bridge 105 ft. long. This is the only iron bridge work on the new line. The contractors are: B. P. Smith, 81 Plymouth avenue, Rochester, N. Y.; McDonald & Sayre, Wilkes-Barre, Pa.; John Shields, Flemington, N. J., and John F. Dolan, Geneva, N. Y.

Southern Pacific.—The new line into Pasadena, in Southern California, has just been completed and the first train on the new line was run from Pasadena to Santa Monica on June 15. The new line is about five miles in length, extending from Shorb on the main line to the town of Pasadena.

The work on the Coast line still continues and the extension is being built slowly south of San Luis Obispo, Cal. The tracklaying has now reached a point about 25 miles south of that town, about 19 miles having been built in 1895. The work is under contract as far as the Santa Ynez River, which is about 50 miles south of San Luis Obispo, but it is not expected that so much of the road will be built this season. John A. McMurtrie and George Stone, both with headquarters at San Luis Obispo, are the contractors.

Toronto, Hamilton & Buffalo.—The Dominion Construction Co., which is building this road, expected to let this week the contracts for building 40 additional miles of line from the city of Hamilton, to which the railroad is now completed, to Welland, which would give another connection with the Michigan Central. The line will extend through the country between the Grand Trunk line, which runs along the shore of Lake Erie to Supension Bridge, and the Michigan Central line to Buffalo.

The company has just secured the necessary legislation form the Dominion Parliament, authorizing it to enter into the proposed contracts with the Michigan Central and the Canadian Pacific for the interchange of traffic between the three lines.

West Virginia Southern.—Several years ago the Coal River Railroad Co. was formed at Charleston, W. Va., to build a line to the Coal River basin, one of the finest timber tracts in West Virginia, with valuable coal deposits on portions of the route. The road was surveyed about the time the panic of 1893 came on, and although some of the right of way had been secured and the money promised for building the line, it was abandoned. Last week Messrs. Herndon & Renshaw, representing capital supposedly from New York, purchased from the original owners the rights and privileges secured by the Coal River road, including the surveys and the rights of way secured. They have applied for a new charter under the above name, and will, they say, let the first five miles of the road to contract within 30 days. This section will begin at Brownstown, and follow the Lens creek valley, and will put the road into the coal territory. There are already three mines in shape to begin work, in a few weeks. From the five mile point, a new survey will be made, shorter than the old one, the new owners owning the lands through which it will pass. It is expected that the heart of the coal river basin can be reached with a ten mile road from Brownstown. This is the plan which has been perfected, but the scheme in contemplation is much more extensive, and includes the continuance of the road to another connection with the Chesapeake & Ohio or to the Norfolk & Western.

Wyoming & Missouri River.—This company has filed articles of incorporation with the Secretary of State at Cheyenne, Wyo. The corporation is to construct a railroad from Alladin, Crook County, on the eastern boundary line of Wyoming and South Dakota, to a point on the Missouri River to be hereafter determined. The incorporators are George M. Mix, who has been interested in railroad projects in the Black Hills of South Dakota, J. Clement Uhler and John M. Greene, all of Pennsylvania. The capital stock is $500,000.

GENERAL RAILROAD NEWS.

Bellaire, Zanesville & Cincinnatti.—J. K. Geddes, General Manager, has been appointed Receiver of the road, a narrow gage line from Bellaire, O., to Zanesville, 110 miles. The company defaulted on the interest on its $216,000 prior lien bonds on July 1. The action was taken at the instance of the first mortgage bondholders, who have been operating the road for some time past. In addition to the first mortgage there are the prior lien bonds. It was to forestall any action on the part of the holders of these bonds that the action was taken.

Birmingham, Sheffield & Tennessee River.—This property is to be sold within 60 days under a decree of the United States Circuit Court at Montgomery, Ala., entered this week. The road has been operated by E. A. Hopkins, of Philadelphia, as Receiver, since June, 1893, and most of the bonds are being held in Philadelphia. The road now operated is about 90 miles long from Sheffield, on the Tennessee River, south through the rich mineral country of Northern Alabama to Jasper, Ala. It is stated that the property is likely to be bid for by the Southern Railway as well as the company's bondholders. An extension of the line to Birmingham, Ala., about 40 miles, has been proposed for some time and surveys have been made in previous years. If the property is purchased by the bondholders it is likely that this extension will be undertaken.

Brigantine Beach.—Howard Carrow, of Camden, Receiver of the railroad, which extends from Brigantine Beach, N. J., to the Philadelphia & Reading Railroad's Atlantic City branch, in connection with which it is operated, sold the road at auction at Atlantic City on June 27. The road was sold on a mortgage foreclosure held by the Holland Trust Co., of New York, which has large financial interests in Brigantine Beach enterprises. The company has defaulted interest on its bonds for several years. The line is eight miles in length, and was built expressly to develop Brigantine Beach. The purchaser was George H. Cook, of New York city, who was acting for the bondholders, the Holland Trust Company, of New York. The bid was $50,000, the amount of the mortgage. An extension to Egg Harbor City is being discussed.

Chicago, Milwaukee & St. Paul.—The report of earnings for May makes the following comparisons for the two years:

	1895.	1894.	1893.
Gross	$,141,003	$2,259,714	$2,701,576
Oper. exp. and taxes	1,311,303	1,534,241	1 903,050
Net earnings	$832,789	$725,472	$798,526
Net 11 months	$9,173,789	$10,253,153	$10,971,580

The company's April earnings were $735,788; in March, $1,035,537.

Cleveland, Cincinnati, Chicago & St. Louis.—The company reports these operations for May and 11 months:

Month of May.	1895.	1894.	Increase.
Gross earn	$1,181,537	$1,020,084	$161,453
Oper. exp	884,669	729,904	154,765
Net earn	$296,868	$290,180	$6,688
Fixed charges	241,062	238,123	2,949
Surplus	$55,806	$52,057	$3,749
Since July 1.	1894-95.	1893-94.	
Gross earn	$12,443 285	$12,012,984	$430,301
Oper. exp	9,332,721	8,992,813	339,908
Net earn	$3,110,564	$3,020,171	$90,393
Fixed charges	2,602,684	2,516,187	86,497
Surplus	$507,880	$503,984	$8.796

Columbus & Western.—The sale of the company's property under the terms of the decree of foreclosure will probably take place within eight weeks after July 1, 1895. R. G. Rolston, M. Taylor Pyne, and N. C. Scudder, the bondholders' committee, have on deposit more than four-fifths of the first mortgage bonds. This road is one of the lines of the Central of Georgia.

Columbus, Sandusky & Hocking.—On June 27 J. H. Stewart, a director of this company, was appointed receiver on application to the State Court at Bucyrus, O., by a petition of one of the stockholders of the company. The application was a surprise to the other directors and officers of the company, and President Guerin and Edward Zurhorst, a director of the company, immediately made application to have the receivership dismissed, and argument on this petition will be heard before Judge Smalley at Sandusky, O., to-day. This road is a consolidation of the Columbus, Shawnee & Hocking and the Sandusky & Columbus Short Line, which was built in 1892 from Columbus to Sandusky, O., 117 miles. The consolidation was effected in December, 1893, and the consolidated company operates a line from Sandusky, on Lake Erie, to Zanesville, O., and to coalfields in the Shawnee region, owning altogether 227 miles, and operating in addition 45 miles of leased line.

Concord & Montreal.—The Boston & Maine stockholders at a special meeting on June 29 voted in favor of the proposed lease of the Concord & Montreal road to the former corporation. The vote stood 127,422 shares for and 30 against.

At the meeting of the stockholders of the Concord & Montreal on the same day to act upon the proposed lease and to increase the capital stock by $1,200,000, a formal protest from owners and holders of Class 4 stock was presented. The lease, being voted upon, was carried by a large majority and the new stock was also authorized.

The proposal to lease the road has been opposed by Director Pierson, who was quoted as follows after the stockholders' vote: There is a probability that the lease will be opposed through the courts. I have been asked to take action, but I feel unable to do so. I shall not take any legal action personally to set aside the lease, although I might lend my influence to such an attempt. I have always believed that the citizens of New Hampshire should control at least one road in New Hampshire, and have always been the opposing force in the Board against any consolidation.

Knoxville, Cumberland Gap & Louisville.—About five years ago suit was brought by the company against the City of Knoxville, Tenn., to compel the issuance of $225,000 worth of bonds, which had been voted in aid of the road. The city refused, on a technicality, to issue the bonds. The suit was carried to the Supreme Court, and the Company has now won its suit.

Lake Shore & Michigan Southern.—The report of earnings for the quarter to June 30, June being partly estimated:

	1895.	1894.	Inc. or Dec.
Gross earn	$9,536,404	$9,396,328	I. $140,07.
Oper. exp	6,347,268	6.195,086	I. 152,182
Net earn	$3.189,136	$3 701,242	D. $12,106
Fixed charges	1.680,000	1,680,000	.....
Profits	$1.509,136	$1.521,242	D. $12,106
Dividend	1,483,995	1,483.995	.....
Surplus	$25.141	$37,247	D. $12,106

The profits were equal to 3.05 per cent. upon the stock, against 3.08 per cent. last year.

Michigan Central.—The company reports the following earnings for the six months ending June 30:

	1895.	1894.	Inc. or dec.
Gross earn	$6,200,000	$6,169,000	I. $31.000
Oper. exp	4.470 000	4,429,000	I. 41.000
Net earn	$1,730,000	$1,740,000	D. $10,000
Int. and rentals	1,200,000	1,200,000	
Surplus	$530,000	$540,000	D. $10,000
C. S. prop	148,000	152,000	D. 4,000
M. C. prop	$382,000	$388,000	D. $6,000
Dividend	374,760	374,764	D. 4
Surplus	$7.240	$13,236	D. $5,996

The Canada Southern brought forward a surplus of $110,822, making total surplus $258,822. The dividend of 1¼ per cent. just declared will require $187,500, leaving a surplus of $71,322.

New York & New England.—In the United States Circuit Court at Boston, on June 29, the two suits brought by Messrs. Roberts & Hart of New York, to restrain the foreclosure of the section mortgage, were withdrawn. The Court intimated that in the bill which raised the point that the foreclosure proceeding is in a suit between citizens of the same state, the case being ancillary to the suit in New York, the objection could hardly be considered. It is understood that no further effort to prevent the reorganization will be made.

The railroad will be sold under foreclosure, in pursuance of the reorganization scheme, on July 9. The control of a majority of the 200,000 shares of stock has already passed, it is claimed, into the hands of men friendly to the Vanderbilts, as it has been asserted many times previously.

New York Central & Hudson River.—The statement of earnings for the quarter (June being partly estimated) shows a deficit of $511,200. Compared with the same quarter in 1894, gross earnings increased $680,613, and the percentage of operating expenses to gross earnings was increased from 69.74 to 70.28. Fixed charges were slightly larger this quarter, and dividend requirements were $178,417 less. The deficit compares with one of $803,652 in the same quarter last year, and a surplus of $87,781 in 1893. The statement for the year ending June 30 shows a deficit of $1,071,200, against $786,340 last year. Gross earnings decreased $1,067,200, and surplus earnings, after payment of fixed charges, showed a decrease of $533,685. The dividend requirements showed a decrease of $248,826 from last year. Below are the comparative statements for the last quarter of this year and 1893 and 1894, and for the three years:

	1895.	1894.	Inc. or dec.
Gross earn	$10,596,700	$9,915,587	I. $680 613
Oper. exp	7,446,600	6,914,594	I. 532 006
Net earn	$3,149,600	$3,000,993	I. $148,607
Fixed charges	2,660,800	2,626,229	I. 34,571
Profits	$488,800	$374,764	I. $114.036
Dividend	1,000,000	1,178,417	D. 178,417
Deficit	$511,200	$803,653	D. $292,453

Northern Pacific.—Judge Jenkins, of the United States Circuit Court, issued an order at Milwaukee, June 27, directing the Receivers of the company to begin suit against Henry Villard to recover about $550,000. According to a statement filed a month ago by the receivers Mr. Villard obtained this amount unlawfully as a commission for negotiating the sale of the Northern Pacific & Manitoba road to the Northern Pacific while being a director of the Northern Pacific and agent of the Northern Pacific & Manitoba. Judge Jenkins also ordered the receivers to begin suits against all former officers of the Northern Pacific who, it is claimed, have obtained money from the company in an unlawful manner.

Ohio Southern.—A protective committee of first mortgage bondholders has been formed consisting of W. A. Read, of Vermilye & Co., New York City, Chairman; Simon Borg, Henry Sanford, ex-President of the Adams Express Co.; Edwin S. Hooley, of Rolston & Bass, and Thomas Denny, of Thomas Denny & Co., New York.

Oregon Railway & Navigation Co.—Messrs. A. A. H. Boissevain, W. G. Oakman and F S. Bangs, agents for the committee representing holders of the collateral trust bonds of the Oregon Short Line & Utah Northern, bought for $1.700,000 the 138,272 shares of Oregon Railway & Navigation Company's stock, sold at auction at New York City, last week, by order of the trustee of the Trust Indenture.

Oregon Short Line & Utah Northern.—The application of the American Loan and Trust Co., of Boston, trustee of the second mortgage bonds, before Judge Merritt, of the United States Circuit Court, at Salt Lake City, for a modification of his recent order appointing John M. Egan and W. H. Bancroft, Superintendent of the Union Pacific, joint receivers of this line, was argued. The counsel for the Trust Company asked that the appointment of Mr. Bancroft as joint receiver be revoked and that Mr. Egan be made sole receiver for the Utah Division, he having been appointed sole receiver for the other divisions of the company's line. The Trust Co. also asked for authority to issue receivers' certificates to the amount of over $1,000,000, which had been authorized by the other courts having jurisdiction. Judge Merritt refused to modify his former decree respecting the appointment of two receivers for the Utah Division and declined to make any order in relation to the application for the issue of receivers' certificates. The counsel of the Trust Co., having failed to secure a modification of Judge Merritt's decree, announce that foreclosure proceedings under the second mortgage will be instituted immediately and no further effort will be made to secure the appointment of an independent receiver.

Pennsylvania.—The report of earnings for May is a very favorable statement. The net profits of the lines east of Pittsburgh and Erie for the month were $278,119 greater than for the same month of last year, and the net profits of the lines west of Pittsburgh and Erie increased $384,277 over those for the corresponding month of last year, making together an increase of $662,396 on all lines for the month of May. For the year to date, five months, the increase in gross earnings on the lines east of Pittsburgh has reached the total of $2,484,000, and the net earnings are $638,641 greater than in 1894. West of Pittsburgh the increase for five months, in gross, has been $1,329,072 and in net earnings $688,083. The following table shows the eanings for the whole system:

Net earn.	Month.	Five Mos.
East of Pittsburgh	$886,179	$2,484,581
West of Pittsburgh	523,565	1,329,072
Increase, gross, whole system	$1,400,764	$3,813,653
Net earn.	Month.	Five Mos.
East of Pittsburgh	$278,119	$638,641
West of Pittsburgh	384,277	688,083
Increase, net, whole system	$663,296	$1,326,724

Roanoke & Southern.—The bondholders of this leased line of the Norfolk & Western, at a meeting at Baltimore last week, failed to accept the proposition made by the Reorganization Committee of the Norfolk & Western in New York, which included the Roanoke & Southern in the reorganization plan of the latter company. The terms of this plan are not made public, but it is stated that the New York committee asked the Roanoke & Southern bondholders to submit a proposition which would be acceptable to the bondholders, and this proposition will be considered by the New York committee of the Norfolk & Western. It is said that this committee hopes to issue the reorganization plan of the Norfolk & Western within the next month. The Roanoke & Southern owns the road from Roanoke south to Winston, Salem, N. C., 124 miles, and has been operated by the Norfolk & Western since February, 1892. That company guarantees the Roanoke & Southern's five per cent. bonds, which amount to $2.041,000, and it owns more than a majority of the company's stock.

Southern Central.—A judgment in favor of the Metropolitan Trust Co., of New York City, was entered in the New York Supreme Court, at Owego, N. Y., against the railroad company and the Lehigh Valley directing the sale of the road. T. C. Platt has been the Receiver since July 3, 1894. The Lehigh Valley has a long lease of the road which gives that company an outlet to Lake Ontario, from the State line above Sayre, Pa. The length of the road is 115 miles.

TRAFFIC.

Traffic Notes.

During the past year 80,000 bales of cotton have been used by the mills at Augusta, Ga.

The business men of Mobile, Ala., are thinking of establishing a freight bureau, and it is said that they have already selected their commissioner.

The Wire Nail Manufacturers' Association, at a meeting in Pittsburgh last week, decided to appoint a general agent to deal with the railroad companies in the matter of freight rates.

The Burlington road lately took up a considerable number of altered tickets between St. Louis and Keokuk. They had been made from summer excursion tickets issued by the New York, New Haven & Hartford last year.

The fruit growers of Georgia have appeared before the State Railroad Commissioners to complain of the freight rates on their products to the North. They say that they have to pay $185 a car on pears to New York, while apples are shipped from New York to Atlanta for only $95.

The Railroad Commissioners of Texas have issued a cotton tariff for the coming season. As compared with the tariff of 1894, the new rates up to 100 miles and over 140 miles are the same as were in effect last season. The reductions between 100 and 140 miles are as follows, as shown in the table: 105, 2 cents; 110, 1 cent; 115 to 125 2 cents; 130, 3 cents; 135, 2 cents; 140, 1 cent.

It is reported that Mr. Power, Industrial Commissioner of the Illinois Central has located in Kentucky, Tennessee, Mississippi and Louisiana, within the past 18 months, 28 manufacturing companies, with a capital of nearly $4,000,000. The Mobile & Ohio, the Queen & Crescent and other roads are said to be doing similar work. The increase in the number and capacity of the cotton mills in the South has been marked during the past year.

Passenger Rates to Atlanta Exposition.

Commissioner W. W. Finley, of the Southern States Passenger Association, has announced rates to the Atlanta Exposition this fall. They are very low. From all points, round trip tickets, good till January 7, 1896, will be 75 per cent. of double one-way first-class limited fares. For distances over 350 miles, round trip tickets with 20-day limit will be one first-class limited fare plus 10 per cent. For distances 51 to 349 miles round trip tickets with 15-day limit will be one first-class limited fare plus 10 per cent.

For 50 miles or less, 3 cents a mile one way for round trip, with 5-day limit.

Rates are also made for round trip tickets from places over 350 miles from Atlanta, which are 2 cents a mile one way plus 10 per cent.

These tickets to be sold Tuesdays and Fridays and good for 10 days. Other rates for bands, military companies, etc., are also named. No lower rates are contemplated at any time during the exposition.

Chicago Traffic Matters.

CHICAGO, July 2, 1895.

The eastbound situation has not improved materially, although great things are expected to come out of the meetings of the Presidents at New York. The eastern lines are all meeting the cuts made on grain, packing-house products, bulk meats and fifth and sixth class freight. The action of the Lake Shore in putting in a tariff of 20 cents per 100 lbs. on packing-house products and provisions from Chicago to New York, a cut of 10 cents, was the last straw and apparently was purposely done with the intention of forcing the Presidents to come together and fix things up. The 20-cent rate has generally been maintained, although there is considerable evidence that some of the roads have been shading that at least 2 cents. The same is true of the rate of 15 cents on grain to the seaboard, parties who ought to know claiming that as low as 12½ cents per 100 lbs. has been accepted on grain the past week. The Central Traffic Association lines met on Friday and made preparations for carrying into effect the agreement of the Presidents to restore rates on July 8th. The basis proposed under the "restoration" will be 20 cents per 100 lbs. on grain and its products from Chicago to New York; provisions and and live hogs, 30 cents; sixth class freight, 25 cents; fifth class freight, 30 cents, and bulk meats 35 cents per 100 lbs.

Just what kind of an agreement will be finally adopted by the Eastern lines is an open question. The committee are still at work on some kind of an agreement that will re-enact the division of tonnage portion of the old agreement, but they have not yet agreed upon any scheme to make it effective.

The Western lines have put in effect reduced rates to correspond with the reductions East, a rate of 25 cents per 100 lbs. on flour being authorized from St. Paul to New York via Chicago, all rail, the same rate to apply also to grain, with a corresponding reduction on grain from Mississippi River points to New York from 23 cents to 17½ cents per 100 lbs.

Freight rates in the West are somewhat improved and the roads are apparently all carrying into effect the agreement to restore Missouri River, Colorado and Texas rates, beginning June 29, except in cases where there were contracts existing running longer. There were very few of these, however, so far as can be ascertained, and it is thought that the most of these expired on July 1. Utah rates remain at the reductions made by the Union Pacific and cannot be advanced until that line is ready to do so. There is considerable trouble yet with live stock rates from the Missouri River, and some of the roads are far from satisfied with the situation. No attempt is being made to form a new association to take the place of the defunct Western Trunk Lines Association. The roads are so far apart on the question of what percentages shall govern the distribution of the business and how these divisions shall be maintained if adopted, that the committee have practically given up all hopes of getting the roads together until some of them experience a change of opinion on these two points. The most feasible plan yet suggested provides for leaving the whole question to arbitration by outside parties, on the theory that it has been proved impossible for the roads to agree among themselves. The radical defect in the old agreement was that the "evening up" was put off too long, until the balances had reached such proportions that none of the lines in excess would agree to even up, making the claim that the fact that they had been able to carry this amount of business should be accepted as proof that the percentages awarded them (and accepted by them when the agreement was made) were too small. Had the officials in charge had the co-operation of the roads and given strict orders that all business should be evened up at junction points daily or weekly, it is the opinion of many that the agreement would not have collapsed.

A meeting of lines of the Western Freight Association is being held here to-day to revise freight rates between Chicago and Mississippi River points made necessary by the adoption of the new classification to govern in Illinois.

The Chicago & Alton on June 30 inaugurated a new "midnight" service between Chicago and St. Louis, a new train being put on leaving Chicago at 11:30 p. m. and arriving at St. Louis at 7:28 a. m., to be known as the "midnight special." A companion train leaves St. Louis at 11:31 p. m., arriving at Chicago at 8 a. m. The time between Chicago and Kansas City has also been shortened to 15 hours.